

**The Planning and Control  
Process of Refurbishment Projects.**

**A Thesis Submitted to the University of London  
for the Degree of Doctor of Philosophy**

**In the Faculty of the Built Environment  
University College London**

97

**By**

**Ismail Bin Rahmat**

1

## **Acknowledgements**

My thanks to the MARA Institute of Technology, Malaysia for financially supporting the work of this thesis.

I would like to express my sincere gratitude to my supervisor, Professor Barbara Young, for her help and guidance. I am also grateful to Dr Charles Egbu for his generous support and perceptive comments and to the staff of the Bartlett for their kind assistance.

I would like to thank my family and my friend Terry Brougham for their support, understanding and patience.

## **Abstract**

This study examines the planning and control process of refurbishment projects. The methods of achieving integration in the process is the main focus of this study. The integrative mechanisms employed by refurbishment project organisations and their influence on planning performance were analysed. The integrative mechanisms include the involvement of the key participants in decision-making, lateral relations, planning and control procedures, communication skills and knowledge and information technology.

This study also highlights the influence of the complexity and uncertainty of the refurbishment projects on the integrative mechanisms used in the process.

In addition, this study examined how the organisation structure of the construction firms influences the extent to which the integrative mechanisms were used in the planning and control process.

Both qualitative and quantitative data were used in this study. A preliminary questionnaire survey was initially conducted, followed by semi-structured interviews with planning and control managers of refurbishment contractors.

A final postal questionnaire, developed and then refined from the interview data, was distributed to the planning and control managers of refurbishment contractors. A total of 67 completed questionnaires formed the data base for the quantitative analysis.

This study concludes that the choice of the integrative mechanisms to be used in the planning and control process should be based on the nature of the complexity and uncertainty of refurbishment projects, the organisation structure of construction firm and the levels of planning performance required.

## **Table of Contents**

Acknowledgements	2
Abstract	3
Table of contents	4
List of tables	9
List of figures	13
<b>Chapter 1: Introduction</b>	
1.0 Problem statement	15
1.1 The rationale for improving the planning and control process of refurbishment project	17
1.2 The areas of planning and control process of refurbishment projects that need improvement	21
1.3 Objectives of the study	29
1.4 Benefits of the study	30
1.5 Structure of the thesis	31
<b>Chapter Two: Research methodology</b>	
2.0 Introduction	33
2.1 Identification of population sample and selection of a sample frame	36
2.2 Preliminary postal questionnaire survey	40
2.3 Semi-structured interviews and archive documentation	44
2.4 Criteria for selecting the construction firms	45
2.5 Final postal questionnaire survey	48
2.6 Data transformation	57
2.7 The theoretical framework	60
2.8 Summary	60



### **Chapter 3: Refurbishment: growth and planning performance**

3.0	Introduction	61
3.1	Factors influencing the growth of refurbishment projects	64
3.2	Refurbishment planning performance	70
3.3	Conclusions and recommendations	94

### **Chapter 4: Complexity and uncertainty of refurbishment projects**

4.0	Introduction	96
4.1	The measurement of complexity and uncertainty of refurbishment projects	96
4.2	The situational variables	100
4.3	The associations between situational variables and refurbishment planning performance variables	146
4.4	Conclusions and recommendations	153

### **Chapter 5: Decision-making in the planning and control process**

5.0	Introduction	155
5.1	Definitions of planning and control	158
5.2	Functions of project planning and control	165
5.3	The involvement of the key participants in decision-making in the planning and control process of refurbishment projects	166
5.4	Research findings on the involvement of the key participants in decision-making at the three refurbishment project stages	168
5.5	The implications of the decision-making gaps	187
5.6	Integration	191
5.7	The involvement of key participants in decision-making and refurbishment planning performance	197
5.8	Guidance notes for the roles and involvement of key participants in the decision-making the planning and control process of refurbishment projects	209

5.9	Summary and recommendations	218
-----	-----------------------------	-----

## **Chapter 6: Co-ordination devices**

6.0	Introduction	221
6.1	The co-ordination devices	222
6.2	Lateral relations	224
6.3	Meetings	232
6.4	Construction company planning and controlling procedures	239
6.5	The communication skills and knowledge of the key participants	257
6.6	Information technology	253
6.7	The associations between the co-ordination devices and refurbishment planning performance	262
6.8	Summary and recommendations	270

## **Chapter 7: The construction firms and the planning and control process**

7.0	Introduction	273
7.1	The organisation structure of the construction firms	275
7.2	The complexity of the construction firms	277
7.3	The Formalisation of organisation structure of the construction firms	282
7.4	The centralisation of the construction firms	296
7.5	The associations between the organisation structure and the planning performance	303
7.6	The description of the theoretical framework	305
7.8	Summary and recommendations	316

## **Chapter 8: Summary, conclusions and recommendations**

8.0	Introduction	318
8.1	Summary of conclusions	318
8.2	Recommendations for further research	326

## **Appendices**

A	Covering letter for the preliminary postal questionnaire survey from the author's supervisor	328
B	Covering letter for the preliminary postal questionnaire survey	329
C	Preliminary postal questionnaire	331
D	List of present job titles of the respondents to the preliminary postal questionnaire survey	334
E	Thank you letter to the respondents to the preliminary postal questionnaire survey	335
F	Results of the preliminary postal questionnaire survey	336
G	Number and size of construction firms visited	338
H	List of planning and control managers interviewed	338
I	Letter requesting an interview with planning and control managers	339
J	Interview sheet	340
K	Covering letter for the final postal questionnaire survey	347
L	Final postal questionnaire	348
M	Letter of reminder for the final postal questionnaire	353
N	Santana's classification of construction projects by scales of complexity	354
O	Associations between the situational variables and the involvement of key participants in decision making of refurbishment project during the pre-bid stage	355
P	Associations between degree of complexity and uncertainty of situational variables and degree Involvement of key participants in decision-making during the pre-construction stage	356

Q	Associations between degree of complexity and uncertainty of situational variables and degree of involvement of key participants during the construction stage.	357
R	Associations between situational variables and the lateral relations	358
S	The associations between situational variables and co-ordination devices	359
T	The integration models for the planning and control process of refurbishment projects	360
	<b>References</b>	361

## **List of Tables**

2.1	The size of the construction firms responding to the preliminary postal questionnaire survey	43
2.2	The rate of response of the final postal questionnaire survey categorised under the construction firms' annual turnover	56
3.1	The cost variance of refurbishment projects	75
3.2	The time variance of refurbishment	77
3.3	The extent to which the planning techniques were used for monitoring during construction	81
3.4	The extent of use of prepared project plans in decision-making	82
3.5	Associations between the degree of detail of planning techniques and the extent to which the planning techniques were used for monitoring during construction	85
3.6	The extent to which project plans were reviewed and revised at the construction stage, during refurbishment	86
3.7	The frequency of revisions of planning techniques during construction stage	87
3.8	The quality of workmanship of the refurbishment projects	88
4.1	The frequency distribution of the size of refurbishment projects	101
4.2	The size of refurbishment projects	103
4.3	The types of building in refurbishment projects	104
4.4	The state of completion of design before refurbishment work commences (comparison of shipping and construction)	107
4.5	The state of completion of design before refurbishment work commences	107
4.6	The degree of changes in design made by the client during construction	110
4.7	The percentage of provisional sum to project contract value	112
4.8	Percentage of structural work relative to project contract value	116
4.9	The percentage of services work to project contract value	118
4.10	The number of subcontractors employed in refurbishment projects	120

4.11	Availability of materials in refurbishment projects	122
4.12	Availability of labour in refurbishment projects	124
4.13	The impact of weather on refurbishment projects	125
4.14	The difficulty of access to refurbishment projects site	128
4.15	The difficulty of access in four types of refurbishment projects	129
4.16	The amount of space available for storage of material on site of refurbishment projects	131
4.17	The frequency of distribution of project size and in traditional and design and build procurement	138
4.18	The contract in use	139
4.19	The associations between the situational variables and the planning performance variables	148
4.20	The cost variance of refurbishment projects using the traditional and design and build procurement systems	151
4.21	The time variance of refurbishment projects using the traditional and design and build procurement systems	151
4.22	The quality of workmanship of refurbishment projects using traditional and design and build procurement systems	151
4.23	The extent to which the planning techniques were used for monitoring during construction of refurbishment projects using the traditional and design and build procurement systems	152
5.1	The relative mean values for the involvement of key participants in decision-making at three refurbishment projects stages	171
5.2	The associations between the involvement of key participants in decision-making during pre-bid stage and planning performance	200
5.3	The associations between the degree of involvement of key participants in decision-making during the pre-construction stage and planning performance	201
5.4	The associations between the degree of involvement of key participants in decision-making during the construction and planning performance	201
6.1	The importance of direct formal contact as a method of obtaining information in the planning and control process of refurbishment projects	226

6.2	The importance of direct informal contact as a method of obtaining information in the planning and control process of refurbishment projects	230
6.3	The importance of scheduled meetings a method of obtaining information for refurbishment projects	237
6.4	The importance of unscheduled meetings as a method of information in refurbishment projects	238
6.5	The extent to which the construction firms planning and control procedures were used by the key participants in refurbishment projects	241
6.6	The level of communication skills and knowledge of the key participant involved in the planning and control process of refurbishment projects	252
6.7	The percentage of refurbishment projects used project management computer software in the planning and control process of refurbishment projects	258
6.8	Associations between co-ordination devices and planning performance	263
7.1	The complexity of construction firms	279
7.2	The size of construction firms: based on average annual turnover for a period between 1992-1994	280
7.3	Construction firms and the involvement of the key participants in decision-making in the planning and control process of refurbishment projects	284
7.4	The correlations between the complexity of the construction firms and the co-ordination devices	287
7.5	Partial correlations between the complexity of the construction firms and the degree of involvement of the key participants in decision-making, with control for project size	290
7.6	Partial correlation between the complexity of construction firms and the co-ordination devices controlling project size	291
7.7	The formalisation of the construction firms	293
7.8	The correlations between the formalisation of the organisation structure of the construction firms and the involvement of the key participants in decision-making	295

7.9	The correlations between the formalisation of the construction firms and the co-ordination devices	295
7.10	The degree centralisation of construction firms	298
7.11	The levels of management in which decisions are made in construction firms	300
7.12	The correlations between the centralisation of construction firms and the involvement of the key participants in decision-making	302
7.13	The correlations between the centralisation of construction firms and the co-ordination devices	302
7.14	Correlation between organisation structure and planning performance	304



## **List of Figures**

1.1	Structure of the thesis	32
2.1	Research methodology	35
3.1	Volume of repair and maintenance and new work since 1955	64
3.2	Shares of housing: new and repair maintenance work by value in 1995	65
3.3	The trends of repair maintenance in housing and non-housing sectors	66
3.4	Index of GDP and construction output	67
3.5	Frequency of differences between final account and tender costs for new and refurbishment projects	74
3.6	The planning techniques used by contractors in the UK	79
3.7	The planning techniques used by refurbishment contractors	79
3.8	The degree of detail of planning techniques at three refurbishment project stages	84
3.9	Theoretical framework	93
4.1	The situational variables and the planning performance variables	147
5.1	The link between planning and control	160
5.2	Relative degree of involvement of the key participants in decision-making at pre-bid, pre-construction and during construction stages of refurbishment projects	172
5.3	The decision-making gaps in the planning and control process of refurbishment projects	178
5.4	The relative degree of involvement of the key participants in the preparation of planning techniques and short-term plans	183
5.5	The relative degree of involvement of the key participants in the preparation of method statement and site layout	185
5.6	Inter-relationships between situational variables, involvement in decision-making and planning performance during the pre-bid stage	206
5.7	Inter-relationships between situational variables, involvement in decision-making and planning performance during pre-construction	207

5.8	Inter-relationships between situational variables, involvement in decision-making and planning performance during construction	208
6.1	Planning procedure matrix	244
6.2	The planning, monitoring and Reporting Procedures in a large construction firm	246
6.3	Project management system used in the United Kingdom and the United States	257
6.4	The degree of detail of the planning techniques used in the planning and control process	260
6.5	Profile of co-ordination mechanisms on classified task uncertainty showing the extent to which co-ordination of mechanisms are used	266
6.6	Inter-relationships between situational variables, co-ordination devices and planning performance	269
7.1	The percentage of medium, large and very large construction firms undertaking small, medium and large refurbishment projects	281
7.2	The average annual turnover of the specialists and general contractors undertaking the refurbishment projects for the period between 1989- 1993	283
7.3	The theoretical framework	306
7.4	A model of the involvement of the key participants in decision making during pre-bid stage	312
7.5	A model of the involvement of the key participants in decision-making during pre-construction	313
7.6	A model of the involvement of the key participants in decision-making during construction	314
7.7	The co-ordination devices model	315

## **Chapter 1**

### **Introduction**

#### **1.0 Problem statement**

Refurbishment, in its many forms, such as modernisation, renovation and rehabilitation is increasingly becoming the most important economic driver for the construction industry in the United Kingdom. In its latest publication, the Department of Environment Statistics (1996) shows that since 1978, the rate of growth of the repair and maintenance (R & M) sector has been outperforming both the rate of growth of the new build and the growth of Gross Domestic Product (GDP) of the United Kingdom. The proportion of the repair and maintenance output in 1995, constituted around 40% of the total output of the building sector.

Unfortunately, there are no official statistics on the actual value of refurbishment work. Young et al (1996) observed that the DoE's statistics on the R & M sector are generally accepted and used by practitioners, government establishments, and academics as the basis for monitoring trends in the refurbishment sector. Since the DoE's statistics on the R & M sector do not take account of 'Do-It-Yourself' (DIY) work, which is carried out by many house owners and the black economy, the actual size of refurbishment work is probably much larger. According to Boyd and Weaver (1994), since major refurbishment is included in new build figures, a more realistic percentage for R & M is over 50%.

The management of refurbishment is facing two distinctive problems. Firstly, refurbishment is generally considered more complex and of higher risk than new build (Hoffmann, 1978; Harrington, 1979; Koehn and Tower, 1978; Chapman, 1980; Teo, 1990 and Boyd and Weaver, 1994). Boyd and Weaver's (1994) study, titled, 'Improving the Management and Operations of Refurbishment Projects' provided evidence that refurbishment projects have more cost and time over-runs than new

build projects. The cost and time over-runs were attributed to the higher uncertainty of refurbishment projects.

Secondly, refurbishment has been relatively ignored, with the focus of research mainly directed to new build (Douglas, 1988; and Young and Egbu 1992a). Quah (1986) argued that estimating, organising and executing the work demands techniques different from those of new build which is more predictable and more capable of positive programming.

The uncertainty variables in refurbishment projects need to be identified. The knowledge with regard to managing refurbishment projects needs to be improved. These two needs provide the main impetus for this study.

Within the sphere of refurbishment management, it is planning, which is inseparable from control, is the most difficult function facing refurbishment managers (Egbu, 1994). The planning and control process of refurbishment projects should, therefore, be the starting point for examination of refurbishment.

The objectives of this introductory chapter are to review : -

1. The rationale for improving the planning and control process of refurbishment projects.
2. The areas of the planning and control process that need improvement, especially on issues of project complexity and uncertainty.

The suggestions drawn from the literature review will provide the framework for this study.

### 1.1 The rationale for improving the planning and control process of refurbishment project

The review of the literature reveals numerous examples of anecdotal evidence presented by various writers on the complexity and uncertainty of refurbishment projects.

Boyd and Weaver (1994) and Quah (1992) observed that when the buildings to be refurbished are occupied during the design stage, complete survey of structural work is difficult to undertake because of limited access to the building, which results in lack of complete drawings to guide the designer and builder in refurbishment work.

Okoroh (1992) pointed out that the inadequacy of specifications from the architects makes it difficult for contractors to define the exact scope of work in advance. As a result, the planning and control of refurbishment works tend to be difficult, for example, in determining the actual time and cost of the works (Okoroh, 1992) and in producing method statements and programmes (CIOB, 1987). The evidence is provided by Quah (1992) in her study titled, 'Comparative variability in tender bids for refurbishment and new build work'. In Quah's (1992) study, it was found that regardless of project size, refurbishment tenders had a higher bid variance than new build tenders. The higher variability in tender bids reflects the inadequacy of specifications and unfamiliarity with the technical problems of refurbishment work.

Quah (1992) said that contractors have to rely more on intuition and 'gut feeling' in the bidding process. Relying on intuition, rather than certain knowledge, is the most likely reason for a wider spread of bids in competitive tendering in refurbishment than in new build.

During the construction stage, refurbishment projects face further complexity and uncertainty. With a high proportion of refurbished buildings being occupied, there is pressure to shorten the construction cycle, which in turn creates a higher intensity of site activity. Refurbishment also consists of small work packages being carried out

simultaneously and scattered throughout the building. This can lead to difficulty in allocating labour resources to achieve maximum productivity (Quah, 1991 and Young and Egbu, 1994).

These problems are further compounded by the limited space and the difficulty of access to project sites. In some cases, these situations may derive from the decisions of the client to set the limit of working space available to work and to store materials, and to limit access to the buildings due, for example, to security reasons. This could lead to difficulty in distributing materials on refurbishment sites. Quah (1990) has demonstrated that the restriction of access and the difficulty of distributing materials are the largest and most variable components in the preliminaries and require more intensive management.

The BRE (1990) cited that because the condition of the existing building is uncertain, the responsibilities of the organisations and individuals on site cannot be clear-cut. Refurbishment work proceeds as a succession of technical problems requiring quick solutions. Frequently, techniques and methods of repairs have to be uniquely developed for each building, even for similar buildings built in the same period. Consequently, to plan and incorporate all uncertainties would be extremely difficult.

In addition, there is also the problem of incorporating statutory legislation, such as fire protection and thermal performance (Boyd and Jankovich, 1993) and the problems of matching new work with old (CIOB, 1987 and Fiedler, 1987)

The complexity and uncertainty of refurbishment projects are often cited as one of the main reasons for refurbishment projects' unsatisfactory performance. The BRE (1990) informs us that the problems in refurbishment projects are often underestimated and the final account frequently rises unacceptably beyond original estimates. Moreover, Boyd (1993) found that more than 50% of refurbishment projects exceeded the tender cost by greater than 5% compared to less than 5% for new build.

The author is of the view that even though the above observations are enlightening, it is not sufficient to give anecdotal evidence to prove that refurbishment projects are more complex and uncertain than new build. What is more crucial and yet still lacking is any attempt to systematically measure the degree of complexity and uncertainty of refurbishment projects. Within the realm of the planning and control process of refurbishment projects, only Whiteman et al (1988), Fiedler (1987) and Young et al (1996) have given any attention to this.

Thus, one of the main aims of this study is to systematically identify the variables that contribute to complexity and uncertainty of refurbishment projects. From the identification of the variables, the most appropriate approaches for the planning and control process could then be developed.

Outside the realm of refurbishment, managing complexity and uncertainty is by no means a new subject. In the field of management, the study on managing uncertainty by Lawrence and Lorsch (1967) is probably the best known and most quoted. Lawrence and Lorsch (1967) said that that the greater the complexity and uncertainty facing an organisation, the greater was the need for specialisation to cope with the additional information. Increased specialisation within an organisation tends to increase differentiation, i.e. the various sub-units having different attitudes, patterns of interpersonal communication, formal hierarchies, and time horizons. Some units reacted more to short-term problems than to long-term opportunities. The greater the degree of differentiation in the organisation, the more pressure to achieve integration.

Uncertainty has been examined from an information processing point of view. Galbraith (1977) said that the greater the uncertainty of tasks that need to be performed by the participants, the greater the amount of information that has to be processed during the execution of the task. Task uncertainty depends on the number of participants involved in the process and the degree of inter-relatedness of their tasks. The higher the number of participants involved, the greater the volume of information that needs to be processed. Similarly, the higher the degree of inter-

relatedness of the tasks of the participants, the higher the amount of information that needs to be processed.

Thus complexity and uncertainty create twin problems, the need to differentiate the tasks to be performed in organisations and the need to co-ordinate the interrelated tasks.

The differentiation of tasks between the multiple participants in a project organisation tends to create communication gaps, which could delay the process of decision-making and implementation. Koontz and O' Donnel (1972) described this as the 'planning gap'. Laufer and Cohenca (1988) concluded that the separation of tasks, for example, between formal authority and technical expertise in construction planning is untenable and artificial. Laufer and Cohenca (1988) emphasised that securing planning integration is a crucial task.

The differentiation and integration of tasks must be appropriate to complexity and uncertainty of the tasks. Specific to refurbishment, Quah (1992) suggested that there is a need to develop techniques which are more responsive to the out-of-sequence multi-trade construction operations, and the often 'fluid' and unknown nature of the works. Hill (1976), Dixon (1990) and BRE (1990) are also of the view that refurbishment works demand management approaches and skills which are different from new build works.

Dixon (1990) emphasised that building modernisation, refurbishment, conservation and maintenance present considerable demands for an industry whose structure, occupational pattern, contractual arrangement and training reflect a pre-occupation with new construction. Dixon (1990) has also argued that it is not sufficient simply to modify these things slightly in order to address the maintenance market successfully; a fundamentally new approach is needed based upon an analysis of the managerial demands which maintenance presents.



It has been suggested that due to complexity and uncertainty, the refurbishment projects need a more flexible approach in their planning, co-ordination and supervision than new build (Douglas, 1988, Jothiraj and Fellows, 1986, Boyd and Weaver, 1994). This suggestion leads to two pertinent questions; how can planning and control process of refurbishment projects be made flexible? Is flexibility the only answer to the planning and control process of refurbishment projects?

Thorough literature review in the domain of refurbishment reveals that the answers to these questions are not totally clear. To the author's knowledge, no systematic study has been conducted specifically on the planning and control process of refurbishment projects. There is, therefore, considerable justification for researching and, thereby improving the planning and control process in this area.

## 1.2 The areas of planning and control process of refurbishment projects that need improvement

A thorough literature review revealed that the complexity, uncertainty and multiplicity of situations posed problems of achieving integration in the planning and control of construction projects. According to Laufer (1994), construction planning is an interactive process performed by multiple participants, at different organisational levels and at different times and locations.

Laufer et al (1994) and Shapira et al (1994) in their extensive research on the involvement of participants in decision-making in construction planning and control, discovered that the construction planning and control process involves many parties, internal as well as external to the construction companies. Laufer et al (1994) also found that the information needed for planning and controlling is not found in one place, nor with one functionary, but rests with all parties. The decisions in the planning and control process are split among the key participants. This situation is termed by Laufer et al (1994) as a 'multiplicity situation'. The multiplicity situation

implies that there are elements of specialisation in decision-making in the planning and control process of construction projects.

Various writers provide reasons for specialisation in the construction process. Laufer and Tucker (1988) cited that the lack of time for project managers and site managers to plan, forced the majority of large construction firms to employ planning specialists or to establish a separate planning department. This strategy effectively took responsibility for planning from the hands of site management. However, the differences in education and training between the site management and the planning specialists result in differentiation in the planning and control process, with site management tending to concentrate on short-term planning and the planning specialists tending to concentrate on long-term planning.

Laufer and Tucker (1988) observed that the delay in completing detailed planning was an inevitable consequence of uncertainty. Since a higher level of uncertainty requires more frequent updating, it is necessary to shorten the communication time between source of information (site) and the locus of the decision-making (head office).

Despite the fact that there is already a tendency for various participants to concentrate on their own area of specialisation, the construction industry employs a procurement system which appears to encourage further differentiation. Hillebrandt (1974), O'Brien (1984) cited that the traditional contract system hindered early planning, because of the low rate of bid success. The contractors have no control over the pace and timings at which bids were issued, and even less time over the awards of contracts. The contractors find it very difficult to pull out a project or site manager from an active project and assign the project /site manager immediately to the new one. Hence, pre-bid planning is left to the planning specialists and therefore the involvement of site management during this stage tends to be low.

There are reasons to believe that differentiation of tasks, coupled with the complexity and uncertainty of refurbishment projects would result in conflicts or power struggles within a project organisation. Corzier (1964) argued that the control of uncertainty

within otherwise routinised situations confers power. Uncertainty of tasks tends to produce vague scope of works. Consequently, each participant makes their own assumptions with regard to who is responsible for the tasks. According to Morton (1983), line managers (for instance, site management personnel) who are expected to accept the planning specialist as an aid to decision-making, actually perceive the planning specialist as a potential threat that constitutes a competing power-base within the organisation.

The existence of differentiation creates the need for integration of an organisation into a unified whole capable of achieving its objectives (Lawrence and Lorsch, 1968; Laufer, 1994; Harrison, 1986 and Boyd and Weaver, 1994). The activities of individuals need to be closely co-ordinated in relation to the project objectives (Lawrence and Lorsch, 1968).

Integration is necessary to foster an understanding of the decisions made by others. Trull (1966) and Le Breton and Henning (1961) are of the view that the difficulties of a proper understanding of decisions made by others creates abstractions that are difficult to communicate and a prime obstacle in implementing decisions. The difficulty in implementing may be reflected in the planning performance. It could be argued that in an uncertain construction project, people with different skills involved in the project determine its success.

Various management writers have proposed some of the methods of achieving integration in organisation. Integration is facilitated by effective formal channels of communications and through reliable and accessible information for staff about their jobs and their firms (Marsh and Simon, 1958; Burns and Stalker, 1961; Lawrence and Lorsch, 1968; and Galbraith, 1973). According to Walker (1989), effective channels of communication could be achieved by the involvement of participants in decision-making. Galbraith (1977) identified integrative devices, such as rules, codes of conduct, standard procedures and appointed co-ordinators as means of achieving integration.

Laufer and Cohenca (1988) proposed that the involvement of all participants in decision-making would improve the prospect for the successful implementation of the plans. The higher the involvement of the participants involved in the planning process, the greater the reduction of uncertainty. Line managers (for example, site managers) and staff experts (for example, planning specialists) share decision-making power. The nature of their co-operation depends on the area of planning and the stage of the construction project.

This proposition raises the following important questions.

1. To what extent should the multiple participants involved in planning and control share in decision-making power?
2. At what stage and in which planning areas are involvement and integration of the multiple participants necessary?

The literature review suggests that the answers to these questions depend on the complexity and uncertainty faced by the project organisation. Duncan (1972) and Van de Ven and Delbecg (1974) for instance, maintained that greater task complexity and uncertainty requires a correspondingly greater input of specialist expertise and information into the problem solving and decision-making processes. Also, task complexity and uncertainty requires a more organic approach to decisional processes and more flexible and participative structures of interaction.

These views are also supported by Lorsch and Morse (1974) and Rus et al (1977) who argue that the turbulence of the environment, up to a certain degree reduces power concentration and increase participative decision-making.

Galbraith (1977) and Bennett (1991) maintain that the activities of the participants need to be co-ordinated to increase the information processing capacity of the organisation. This could be achieved by employing co-ordination devices.

Galbraith (1973) identified various co-ordination devices or mechanisms that could be used to provide co-ordination and to increase the information processing capacity in an organisation. Among the co-ordination devices identified are procedures, information systems and lateral relations.

Thus, the important requirements of refurbishment projects with a high level of complexity and uncertainty are two-fold. Firstly, the ability to co-ordinate the activities of the participants. Secondly, the ability to increase the information processing capacity.

According to Bennett (1991), procedures provide co-ordination by predetermining decisions. Given the discretion to make their own choices, separate participants will decide, often arbitrarily, on different approaches. This creates extra work, as each participant needs to reconcile inconsistent information obtained from different sources.

Many would argue that complex and uncertain refurbishment projects may require a more flexible approach in the planning and control process and that standardised procedures would cause rigidity in the process, thus slowing down the flow of information.

Bennett (1991: p. 89) Warned of the shortcomings of using procedures as a method of co-ordination and said that, 'procedure, however, can only go only so far; they deal with situations which can be anticipated and which recur sufficiently frequently to justify a predetermined answer. Other situations need other co-ordination devices'.

The rigidity imposed by standardised procedures requires the decision-makers in planning and control of refurbishment projects to be in constant communication with each other to convey the plan of actions. The more complex and uncertain the project, the greater the need to communicate and the greater the tendency for the refurbishment project organisations to suffer from information overload. The refurbishment project organisations have to rely more on the communication skills

and knowledge of the decision-makers. Communication integrates all the participants. The communication skills of professionals, by applying knowledge to practical problems, act as an important co-ordination device.

Modern communications, however, employ diverse media, from oral to letter and memos to information technology. Egbu (1994) found that the majority of refurbishment managers perceived that the use of computer technology to be one of the most difficult tasks in managing refurbishment projects. The use of computers, however, may be indispensable in complex and uncertain refurbishment projects. The lack of compatibility of the computer systems and the knowledge of the key participants in computer technology would impede the effectiveness and efficiency of information technology as a co-ordination device (Bennett, 1991; Connors et al 1991 and Pietroforte, 1997).

The large number of participants involved and the interactive nature of the planning and control process demands increased informal communication and mutual adjustment of the key participants. The use of IT is no substitute for human contact. Face-to-face meetings provide richness of communication. The feedback is instantaneous and enables immediate correction and interpretation.

Bennett (1991: p.111), maintained that, 'direct meetings are generally effective in providing co-ordination. The managers directly involved know the relevant information and generally have a real interest in sharing it with others working at the same level in the same project'. In fact, Bennett (1991) also observed that when no formal arrangements are built into project organisation, informal lateral meetings emerge.

The main concern of using informal meetings, however, is that of ensuring that the information obtained directly from a particular participant is not in conflict with the interest of other participants or the project as whole. In a complex and uncertain refurbishment project, the needs of each participant is in a state of constant change. What is relevant to one participant, at a particular time, may no longer be relevant to

the others. Thus, informal lateral meetings are two-edged swords, it may be effective in speeding up information flow, but may cause conflicts in the process.

The above discussions suggest that even though there are various ways of achieving integration in the planning and control process of refurbishment project, each method has its limitations that could reduce their effectiveness. It appears that providing a solution to one problem raises another. This gives some credence to the fact that the interrelated issues of complexity and uncertainty and integration need to be tackled holistically. It also suggests that in the planning and control of refurbishment projects a combination of integrative mechanisms need to be employed. However, the extent to which these should be employed is not totally clear. It is imperative to establish the most appropriate integrative mechanisms and how best to deploy them.

There is, however, another dilemma in the integration of a construction project. On the one hand, there is a need to direct activities by employing integrative mechanisms in the construction processes towards the specific needs of the project (Bresnan, 1990; Walker, 1989; Winch, 1989). On the other hand, the integrative mechanisms which control the activities should allow for the maintenance of the organisation structure that is already in place in the construction firm. Each construction firm has long-term objectives such as increasing productivity and improving service, and therefore design their organisation structure accordingly (Walker, 1989).

It is most probable, that since a project is a temporary organisation, while a firm is a more permanent one, the organisation structure of construction firms tend to influence the activities of participants involved in the construction processes. Many construction firms would be unwilling to make drastic changes to the long established organisation structure of the firm, which is used to co-ordinate the activities of the employees within the firm, to suit the needs of individual construction projects. For example, a participant employed in a large construction firm with a high degree of formalisation would tend to follow formalised procedures, even though the procedures could hamper the overall success of the refurbishment project.

There could be instances when the need of maintaining the organisation structure of a construction firm and the need to provide integration in a construction project are in conflict. As a result, the construction project does not get the appropriate integrative mechanisms. In fact, Bresnan (1990) observed that the more a construction project requires a flexible form of organisation, the less likely it is to get it because of the conflicts between the needs of the firm and the needs of the project.

It would be beneficial to investigate how diverse construction firms resolve the conflicting needs between maintaining the organisation structure and integration in refurbishment projects. The methods of resolving these conflicting needs could be established by analysing the relationships between the integrative mechanisms used by diversified construction firms to plan and control refurbishment projects and the organisation structure of their firms.

Galbraith (1977) observed that the choice of integrative mechanisms is to bring about coherence between the goals for which the organisation exists and the type of uncertainty faced by the organisation. Applying this principle in planning and control of refurbishment projects means that the integrative mechanisms to be employed should be appropriate to the nature of complexity and uncertainty and to the level of planning performance required in the projects.

Boyd and Weaver (1994) attributed the tendency for refurbishment projects to exceed the target cost to the uncertainty of refurbishment projects. In Boyd and Weaver's (1994) study entitled 'Improving the management and operations of refurbishment projects', more than 50% of refurbishment projects exceeded their target cost. To establish the most appropriate integrative mechanisms to be used in planning and control process of refurbishment projects, the relationships between the integrative mechanisms and planning performance variables need to be established.



### 1.3 Objectives of the study

The main objectives of the study can be documented as follows: -

- a) To establish the variables that contribute to complexity and uncertainty in refurbishment projects.
- b) To examine the involvement of key participants in decision-making in the planning and control process of refurbishment projects and to establish the appropriate levels of involvement of key participants in the process.
- c) To establish the co-ordination devices needed in the planning and control process of refurbishment projects.
- d) To compare the integrative mechanisms used by diversified construction firms in the planning and control process of refurbishment projects.

The main hypotheses of this study are as follows: -

- 1. Planning performance depends on the nature of the complexity and uncertainty of refurbishment projects.
- 2. Planning performance depends on integrative mechanisms used in the planning and control process of refurbishment projects.
- 3. Planning performance depends on the organisation structure of the construction firms.
- 4. The integrative mechanisms used in the planning and control process of refurbishment projects depend on the organisation structure of the construction firms.

#### **1.4 Benefits of the study**

It is anticipated that the study will specifically benefit individual planning and control managers, refurbishment firms, educators and clients of the construction industry as follows : -

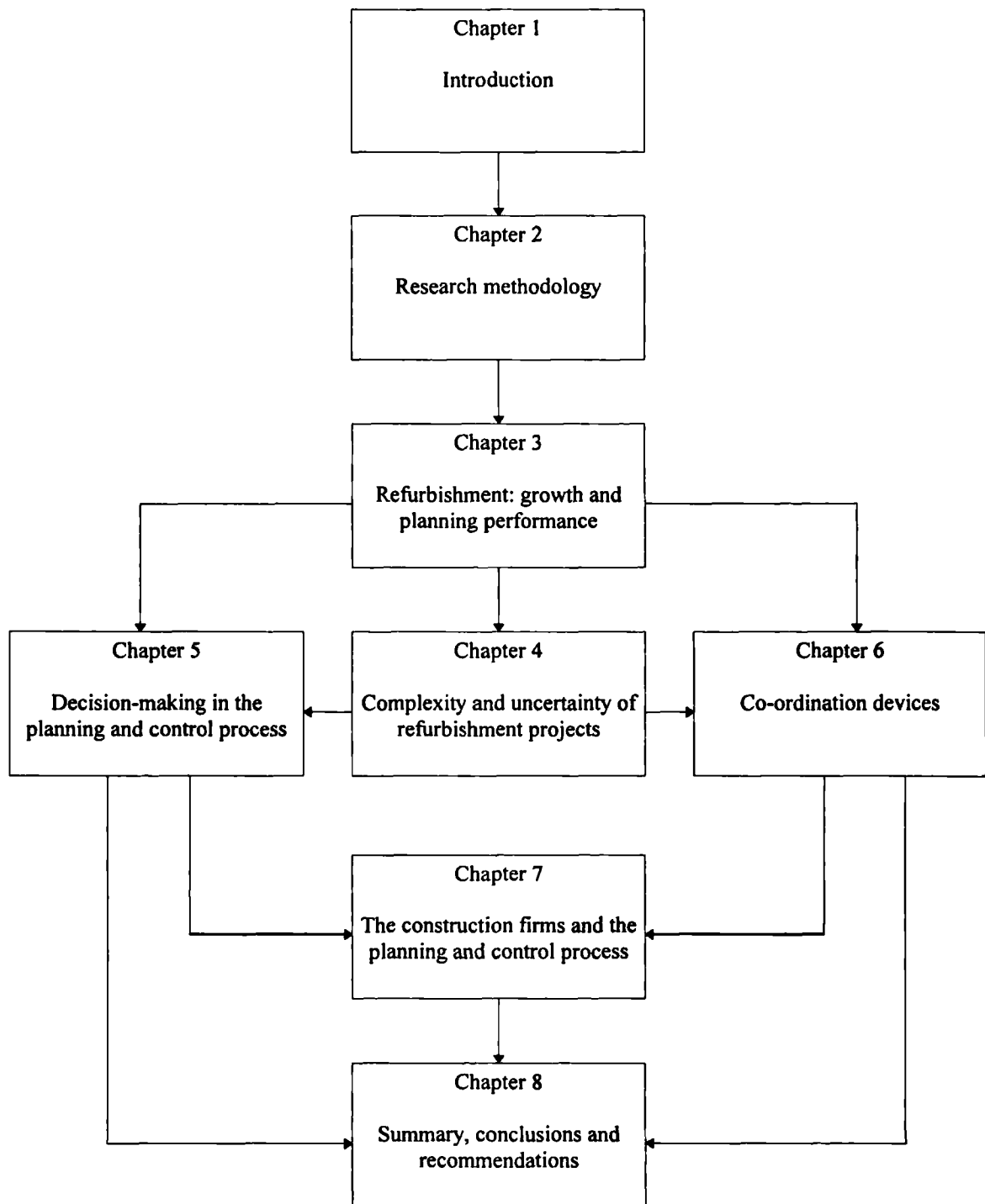
1. The identification of the main factors that contribute to complexity and uncertainty of refurbishment projects should be of value to individual planning and control managers, as it could help them to formulate appropriate planning and control strategies for carrying out refurbishment projects.
2. The identification of the factors that contribute to the complexity and uncertainty of refurbishment projects may assist with the matching of skills with jobs for those involved with the planning and control process of refurbishment projects. For individual planning and control managers, the establishment of their roles may further help to reduce conflicts among them.
3. The findings of the study may help to improve the clients' awareness and understanding of the complexity and uncertainty associated with refurbishment projects. This may help them to take precautions, for instance, to improve safety and profits. The findings may also encourage them to provide necessary provisions in order for the refurbishment contractors to carry out the works efficiently.
4. The factors that contribute to the complexity and uncertainty of refurbishment projects identified in this study could provide further insights for researchers in understanding the main problems associated with refurbishment projects. Research on each main factor that contributes to the problem could then be carried out in greater depth.
5. The results of the study should assist refurbishment firms to choose the most appropriate co-ordination devices in refurbishment projects.

6. An establishment of appropriate integrative mechanisms for refurbishment should allow educators to advise on and provide relevant courses for existing managers and those aspiring managers associated with refurbishment.
7. For the construction industry, especially for construction firms undertaking refurbishment projects, the results may help to improve refurbishment project performance. This may help to improve the image of the refurbishment sector and the construction industry as a whole and help to provide incentives for clients to carry out refurbishment work.
8. Educators may benefit from incorporating the body of knowledge into their courses for refurbishment.

### 1.5 Structure of the thesis

The thesis is organised in a logical manner in order to enable the reader to appreciate the thoughts of the author in achieving the objectives of the study. The structure is shown in figure 1.1.

Figure 1.1 Structure of the thesis



## **Chapter Two**

### **Research methodology**

#### **2.0 Introduction**

The methodological procedure is to ensure that the information obtained for this study is rigorously obtained, relevant and capable of scientific evaluation.

The data necessary for statistical analysis for this study could not be found from the literature review. Therefore, primary data collection had to be carried out.

The literature review reveals that the primary data could be collected in several ways. Buckley et al (1976) grouped the methodology of data collection under four headings, namely opinion research, empirical research, archival research and analytical research. Each method has its own strength and limitations, and none could be considered as superior to the other. The decision as which methods to use must be based on the survey objectives, the nature of the information required and the resources available (Jobber, 1991).

The opinion and archival research methodology was adopted by the author for this study. It is a combination of survey research - semi-structured interviews and postal questionnaire survey and archival documentation. There are many advantages of combining several research procedures. Different methods yield different kinds of data, which taken together facilitates a more comprehensive analysis of the phenomenon studied (Luthens, 1972; Moser and Kalton, 1971; Babbie, 1973; Bouchard, 1976). The data from semi-structured interview for example produce qualitative data that enabled the author to enrich the content of the study by highlighting phenomena and clarifying areas that deserve further explanations. The postal questionnaire survey on the other hand, collects original data that may be

capable of statistical analysis. Archive documents are mainly used to provide illustrations and examples of specific cases in refurbishment projects. Thus, the three methods complement each other and enrich the research.

The summary of the research methodology follows the procedure as shown in figure 2.1. Each step of the research methodology is described in detail in sections 2.2 to 2.6.

The non-existence of an official directory of refurbishment contractors and the types of refurbishment projects undertaken by them presented limitations at the beginning of this study. Firstly, the problem of identifying the population sample to be surveyed in this study. Secondly, the problem of determining the refurbishment project parameters.

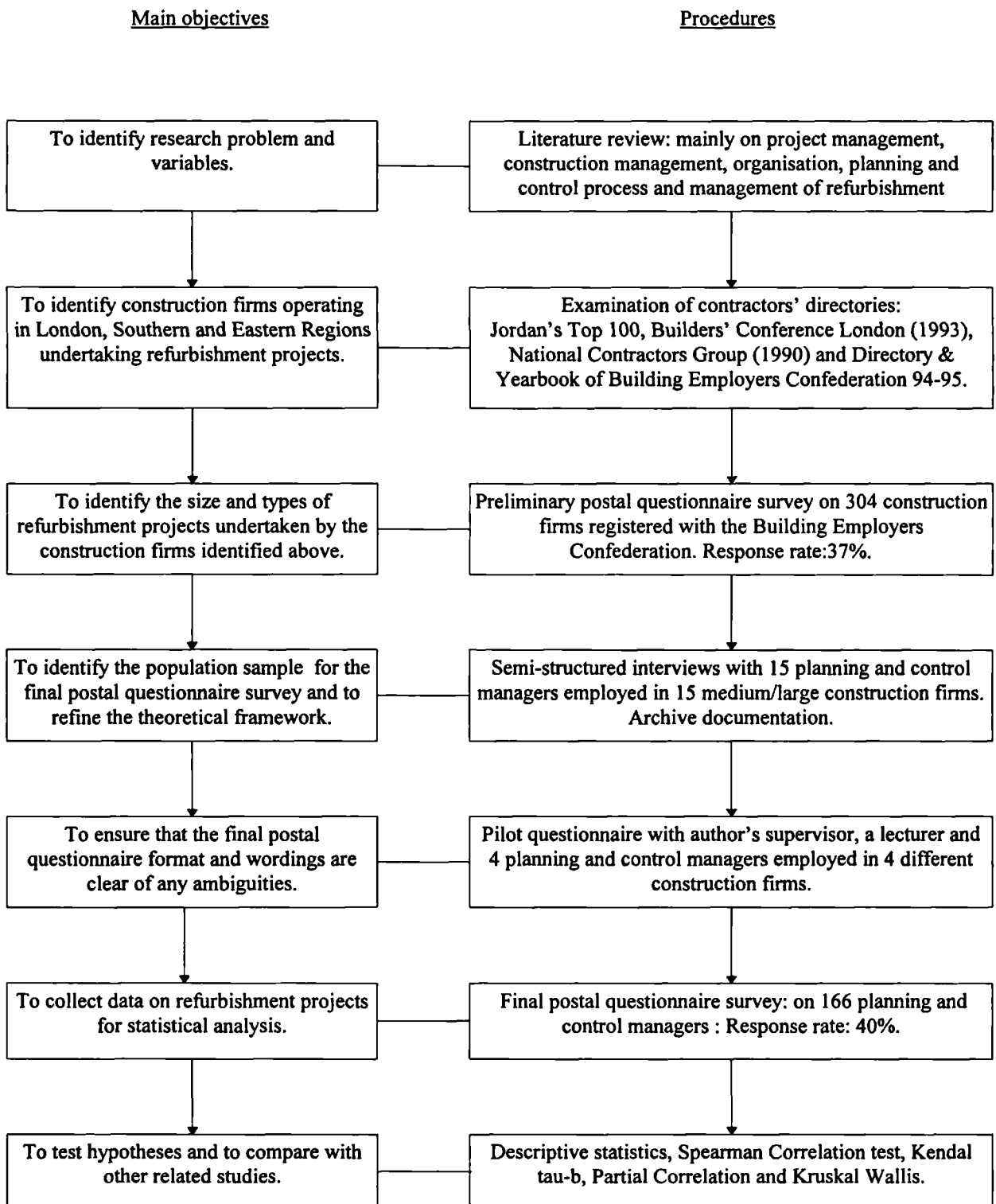
Because of the constraints imposed on data collection, a three-stage methodology was introduced. The first stage, was the preliminary postal questionnaire survey which was intended to identify the population, i.e. the construction firms undertaking refurbishment projects and to establish refurbishment project parameters.

The preliminary postal questionnaire survey was followed by stage two, semi-structured interviews and archive documents, with the main objective to refine the research problems and to set the theoretical framework for this study. The last stage was the final postal questionnaire survey, with the main objective to collect the primary data for statistical analysis.

The purpose of this chapter is to explain: -

1. The objectives of the three-stage data collection process.
2. The procedures and mechanisms employed in each stage.
3. The limitations governing the sample survey.
4. The statistical techniques and measures used for data analysis and transformation.

Figure 2.1 Research methodology



## 2.1 Identification of population sample and selection of a sample frame

It is important in any study to have a homogenous and comprehensive population sample. In this study, the population sample must also give true representation of the complex and uncertain nature of refurbishment projects. The refurbishment projects' parameters also needed to be set to ensure that the intervening variables would not distort the measurement of the variables this study intended to measure. The intervening variables are to be kept to minimum.

At the outset, the author decided to set three general project parameters. The author believed that as the study progressed to semi-structured interview stage, more information would be obtained, and therefore, more specific project parameters could then be set. The specific refurbishment project parameters are explained in section 2.5.1.

The first general project parameter was that the refurbishment project must be of high degree of complexity and uncertainty, which is normally associated with refurbishment projects of 'large' contract value (Bennett 1991; Harrison, 1992). Thus 'large' refurbishment projects were targeted for the following reasons:

- a) To ensure that the refurbishment projects under study are not repair and maintenance, which tend to be smaller in size.
- b) The issues of planning and controlling are more complex and uncertain in nature in large refurbishment projects, and therefore need more urgent solutions.

It was imperative to identify the construction firms that carry out large refurbishment projects before the target population, that is, the managers who are involved in the planning and control process of refurbishment projects could be identified. Medium and large construction firms were targeted because:



- a) Large construction projects tend to be carried out by medium and large construction firms (Hillebrandt, 1990).
- b) Medium and large construction firms tend to be more successful and have more established procedures than small ones (Quah, 1992).
- c) By virtue of size, large construction firms employ a large number of managers. Therefore co-operation would be more readily available (Egbu, 1994).

The second general refurbishment project parameter is that the refurbishment projects must be carried out by construction firms operating within a geographical area that is fairly similar in character and within the vicinity of London. The reasons are to avoid the regional variations from influencing the results of this study and ensure the efficiency and economy of the data collection process since the author is resident in London.

The third general refurbishment project parameter is that the refurbishment projects must also have been carried out within the past three years when the final postal questionnaire survey was to be conducted. This is to minimise the distortions due to differences in market conditions.

The initial problem was therefore to locate the refurbishment projects with the above three parameters.

The author discovered that there were 84,885 construction firms registered with the Department of Environment in 1991-1992 (DoE, 1993). The construction firms employ from 1 to over 1200 employees. The majority of these construction firms (98%) employ less than 25 employees, which Young (1988) classified as small construction firms. Only 1,776(2%) of them employ more the 25 employees, which could be categorised as medium to large size construction firms. The Department of Environment data did not indicate which of these construction firms undertaken

refurbishment projects. If a survey were to cover all the 1,776 medium and large construction firms, the cost would be prohibitive.

A census was therefore ruled out on practicality and economic grounds. Moreover, many researchers agreed that when the population is large there is little benefit to be gained from undertaking a census (Moser and Kalton, 1979; Payne, 1977). It is sufficient to carry out a sample survey, provided that the sample population is representative. Under representation is more often than not, to be the case (Fowler, 1984).

To reduce variability due to location, the author chose to conduct the survey on refurbishment projects undertaken by construction firms operating within London, South and East of England. This decision simultaneously reduces the number of the construction firms to be surveyed. Besides, this geographical area in 1992 took 42 % of all repair and maintenance work (DoE 1993; Egbu 1994), and is therefore the most important economic region as far as refurbishment is concerned.

In order to obtain a representative sample of refurbishment contractors operating within London, South and East, the author examined four contractors' directories obtained from four different organisations.

The Directory of Building Contractors obtained from the Builders' Conference was first examined. It listed only the telephone number and contact name of all construction firms operating in the United Kingdom. The construction firms undertaking refurbishment projects could not be identified from this directory and the addresses given were incomplete. This directory was considered to be unsuitable for the purpose of this study.

The Jordans' Top 1000 Construction Firms in the United Kingdom (1993) was then examined. It listed all 'construction' firms involved in the construction industry in the UK including materials, plant and services suppliers. Again, construction firms

undertaking refurbishment projects could not be identified. Thus the idea of using this directory was abandoned.

The author then contacted the National Contractors Group (NCG), and the Building Employers Confederation (BEC) to obtain the addresses of their members.

The National Contractors Group Membership Directory (1990) provided among others, the addresses of 76 construction firms, the types of work, including refurbishment and geographic areas of operation. Though the author could identify the construction firms undertaking refurbishment project from this directory, later discovered that construction firms listed, comprised only the largest construction firms in the United Kingdom. It excluded many medium and large construction firms operating within London, South and East of England and therefore the listed construction firms in this directory were considered to be highly unrepresentative.

Finally, the author obtained the Directory & Yearbook of Building Employers Confederation 1994-995 for London, Southern and Eastern Regions. The directory listed 1992 construction firms. The construction firms were classified into registered head office, firm size (small, medium and large) and the types of work they do (for example joinery, plasterer and painting). Unfortunately the directory did not identify whether or not these construction firms undertake refurbishment projects.

Due to the difficulties in identifying the construction firms undertaking refurbishment projects from all of the above directories, the author decided to conduct a preliminary postal questionnaire survey. The main aim of the preliminary postal questionnaire survey was to produce the author's own directory of refurbishment contractors. The BEC 's directory was used for the preliminary postal questionnaire survey.

## 2.2 Preliminary postal questionnaire survey

Only 304 construction firms were listed as medium and large in the BEC's directory for London, Southern and Eastern region. As this was a manageable number, the author decided to survey all of them. The primary objectives of the questionnaire survey was to obtain general information about the construction firms, the types of refurbishment projects undertaken by them, and to identify the managers involved in the planning and control process of refurbishment projects. The secondary objective was to introduce the author to the senior management of the construction firms. In so doing, it was hoped that further co-operation could be more easily obtained at the following stages of the study, i.e. the semi-structured interview and the final postal questionnaire survey.

The information to be obtained by the preliminary postal questionnaire survey was about the construction firms characteristics and the types of refurbishment project undertaken by them. Very general information of the planning and control process of refurbishment projects was also elicited.

The literature review revealed that information about construction firms, project characteristics and project planning performance could be obtained from managers holding a wide range of positions. Naoum (1992) with his comparative study of management and traditional contracts planning performance, for example, surveyed project manager, contract manager, etc. (*sic*). Faniran et al (1994) in his study on the effectiveness of construction planning, identified the population as merely 'appropriate planning and contract management personnel'.

Few would argue that the most appropriate population to provide information on the planning and control process are the managers who are involved in the process. But the planning and control process is the most important component of management and therefore almost all managers in a construction firm would be involved in the process to a varying degree.

Laufer et al (1994) obtained the information on the planning and control process by asking the construction firms to select managers on the basis of 'individual experience and competence'. What they found was that the planning and control managers included project executives, project managers, project engineers and site superintendents (Laufer et al 1993; Shapira and Laufer, 1993; Cohenca and Laufer, 1994; Laufer et al 1994 and Shapira et al 1994) and also planning and scheduling managers (Laufer, 1991).

Due to the very general nature of the information to be obtained at the preliminary postal questionnaire survey, i.e. on the types of construction firms and on general information of the planning and control process of refurbishment projects, either the managing director or the managers identified by the managing director involved in the process were considered to be appropriate. The preliminary postal questionnaires were therefore addressed to the managing directors of the 304 construction firms identified earlier. The author also requested that if the managing directors were unable to answer the questionnaires, that they would redirect the questionnaires to the managers employed by their firms who were involved in the planning and control process of refurbishment projects.

The preliminary postal questionnaire was designed to be short, only 3 pages long. This was to ensure a high response rate. Otherwise, the author believed, the succeeding data collection stage would be adversely affected. With this in mind, the author decided that further benefit could be achieved from this survey by including only minimal and general questions on the planning and control process. The objective of including general questions on the planning and control process is to verify the importance of a few variables mentioned in the literature review. The verification would help the author in formulating the semi-structured interview to be conducted after the preliminary postal questionnaire survey.

The author also requested the respondents of the preliminary postal questionnaire survey to provide the organisation chart of their firms. The names and job titles of the managers provided by the organisation charts would enable the author to identify the appropriate managers to be interviewed at the next data collection stage of the study.

A letter of introduction from the author's supervisor and a covering letter were attached to the preliminary postal questionnaire. They are shown in appendix A, B and C respectively. A reply envelope was also attached to each questionnaire to encourage response.

The preliminary questionnaires were distributed in the first week of December 1994. After 6 weeks, 113 questionnaires were returned, giving a rate of return of 37%. Only 103 questionnaires, however, were found to be useful. Two respondents refused to answer because of their firms' policy of not participating in research. Three respondents could not answer because their construction firms did not undertake refurbishment projects. Five questionnaires were returned unopened because of change of address.

The responses came mainly from managing directors, project managers, contract managers, planners and operation managers (see appendix D).

A thank you letter from the the author was sent immediately after the questionnaires were returned to the author. The sample of this letter is shown in appendix E.

The results of the preliminary postal questionnaire are shown in appendix F.

As the preliminary postal questionnaires had been distributed randomly to the construction firms, with no knowledge as whether or not the construction firms undertake refurbishment projects, it was therefore difficult to judge the response rate. The rate of response is affected inter alia, by the interest of the respondent in the research (Moser and Kalton, 1969). It is highly probable, that the construction firms

that did not carry out refurbishment projects were less inclined to respond. Due to non-existence of any official directory of construction firms undertaking refurbishment projects, the author felt that it was sufficient to proceed to the next stage of the study based on refurbishment projects to be obtained from the 103 construction firms.

The size of the construction firms who responded to the preliminary postal questionnaire survey varied, as shown in table 2.1. The construction firms whose latest annual turnover was between £11 million to £100 million form the largest group.

Table 2.1 The size of the construction firms responding to the preliminary postal questionnaire survey

Size (annual turnover 1993)	construction firms (N=103) %
Less than £1 million	6.3
£1 million to £10 million	40.9
£11 million to £100 million	41.4
More than £100 million	11.4

Ashworth and Skitmore (1983) and Quah (1992) classified construction projects into small (contract value less than £20,000), medium (contract value £20,000- £100,000), large (contract value £100,000 -£1,000,000) and very large (contract value more than £1,000,000). Based on this classification, it was found from the preliminary postal questionnaire survey that 94(94.2%) construction firms undertake large refurbishment projects, and 72(69.9%) construction firms undertake very large refurbishment projects.

### 2.3 Semi-structured interviews and archive documentation

The preliminary postal questionnaire survey had already identified 94 construction firms having had a track record with large and very large refurbishment projects. The next step was to gain co-operation from the construction firms' personnel with the objective of conducting face-to-face, semi-structured interviews with their planning and control managers.

There are five main objectives of the semi-structured interview. Firstly, selected interviews with firm representatives would provide a framework and in-depth discussions for assessing the scope of questions needed for the final postal questionnaire survey. Additional variables, which the author may have overlooked during the literature review would emerge or become relevant. It is a more flexible way of obtaining information. Secondly, during the semi-structured interviews ambiguity in questions or answers could be clarified by the author immediately. Thirdly, it would enable the author to identify the population for the final postal questionnaire survey. Fourthly, to help the author to gather relevant documents on the planning and control process. And lastly, it would provide an opportunity for the author to seek further co-operation from the participating construction firms for the final stage of data collection, i.e. the final postal questionnaire survey.

The literature review revealed that there are two precautions that need to be taken by the interviewer during interviews to ensure the answers given by the interviewees are not biased. The first precaution is to for the interviewer to avoid leading questions. And the second precaution is for the interviewer not to impose too much in conversation. (Bouchard, 1976; Shapiro, 1970; and Collins, 1970). Leading questions could come unintentionally. The author took both precautions during the semi-structured interviews.



## 2.4 Criteria for selecting the construction firms

Since the emphasis of this study is on medium and large refurbishment projects, only representatives from construction firms undertaking refurbishment projects with a contract value of more than £100,000 were interviewed. The preliminary postal questionnaire survey has also indicated that procurement systems appear to play a part in the accuracy of time estimates. This is one of the criteria of planning performance. 46% of the respondents perceived that procurement system affected the accuracy in time completion to a great extent, 18% neutral and 26% to a small extent (see appendix F). These perceptions need to be verified. Thus comparison in terms of planning performance between procurement systems in the planning and control process is considered to be necessary. Two procurement systems were found to be the most dominant, i.e. the traditional and design and build procurement systems. Out of ninety-four construction firms, 97% of the them had experience of refurbishment projects using traditional and 78% had experience in design and build procurement systems. The number of construction firms carrying out construction management, management contracting and other procurement systems were small, less than a quarter each (see appendix F).

With the time and financial resources available to the author, it was only feasible for this study to include the two most dominant procurement systems, i.e. the traditional and design and build.

There are two reasons for this. Firstly, since the traditional and design and build procurement systems are two of the most commonly used, primary data relating to them could be obtained more easily from a large number of construction firms. The danger to include all the procurement systems employed by the construction industry would spread the refurbishment projects too thinly among them, which could prevent this study from conducting rigorous statistical analysis. Besides, the data relating to the other types of procurement systems could only be obtained from a very small number of construction firms. To get a sufficient number of projects using these

procurement systems was considered to be difficult. The case study method, rather than postal questionnaire survey is considered to be more appropriate when the sources of information could only be obtained from a small population.

Secondly, the traditional and design and build procurement systems differ significantly in terms of risks ownership. In traditional procurement system, most of the project risks are borne by the client whereas in design and build most of the project risks are borne by the contractor (Winch, 1989, Masterman, 1988). The risk ownership plays a significant contribution on the organisation of the construction projects (Winch, 1989) and therefore, was considered by the author to be one of the major factors which determines the level of involvement of the major participants in the planning and control process.

Therefore the construction firms selected for the semi-structured interviews must also have experience in traditional and design and build refurbishment projects.

The review of literature revealed that in complex and uncertain construction projects, the problem of integration is greater (Bresnan, 1988). This is caused by greater organisational interdependency in the construction project process. Yet integration is necessary to ensure the success of any construction project. Since the main concern of this study is to address the issues of integrating the multiple participants involved in the planning and control process of refurbishment projects, it was considered to be most appropriate to survey the perceptions of the managers who are involved and may need to be integrated in the process.

It was the intention of the author to obtain a homogenous sample, so that no bias was introduced in the study, which could be derived from the differing degree of involvement of the managers in the refurbishment projects. The organisation charts obtained during the preliminary postal questionnaire survey, however, gave very few indications of the most appropriate population due to the variability of the job titles.

Many smaller construction firms for example, did not have planner or project manager and some did not have contract manager. Also, when the managing directors were asked to identify the planning and controlling managers, the job titles were discovered to be varied. This confirms Laufer et al (1994) and Young (1988) findings that planning and controlling are carried out by many functionaries. The failure of Faniran et al (1994) to define the planning manager is enlightening. But to the author, at this juncture, the findings of the preliminary postal questionnaire survey and of the other studies in this subject are by no means conclusive. The author considered that the general nature of the questions in the preliminary postal questionnaire survey led to the author obtaining responses from managers with varied job titles. The author intended to obtain a more homogenous sample for the most vital stage of the study, the final postal questionnaire survey, which is more specific in nature. Therefore among the primary objectives of the semi-structured interview was to establish the population for the final postal questionnaire survey.

From the original sample of 94 construction firms, 15 construction firms with annual turnover ranging from £3 to £200 million per annum were chosen. The other criterion was that they undertake large refurbishment projects using both traditional and design and build procurement systems. After the construction firms had been selected, the author obtained the names of the planning and controlling managers from the construction firms' secretary by telephone.

The size and types of the construction firms is shown in appendix G. The list of the job title of the planning and controlling managers is shown in appendix H.

Prior to the semi-structured interview, a letter outlining the objectives and the information needed to be obtained from the interview was distributed to the selected planning and control managers for the interview. It was mentioned in the letter that the interview was to last about one to one-and-a-half hours. The author also agreed to telephone the planning and control manager within the week after the letter being posted to arrange for an appointment. A copy of the letter is shown in appendix I.

The letter preceding the telephone call was intended to introduce the author to the interviewees and to explain the purpose of the interview. This was done in order to save the planning and controlling manager's time. The author believed that by so doing, co-operation would be more readily given. This strategy was proved to be successful. All 15 planning and control managers contacted agreed to be interviewed.

The semi-structured interviews were conducted during May and June 1995. The interviews took place at the head offices of the refurbishment construction firms. During six interviews the author also managed to obtain various documents on planning and control and names of the most appropriate planning and control managers to whom the final postal questionnaire survey would be sent. Thank you cards were sent to each participating planning and control manager immediately after the interviews were conducted.

A copy of the interview format is shown in Appendix J.

## 2.5 Final postal questionnaire survey

The objectives of the study could further be achieved by the final postal questionnaire survey for the following reasons.

1. With postal questionnaire survey, the author could cover a wide spread of sample population and likewise, refurbishment projects. Also, as a method of data collection in social research, the postal questionnaire survey is relatively cheap, simple and easy to administer.
2. The survey can overcome the generalisability problems posed by the experimental and case design (Luthans, 1992).

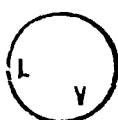
3. It also provides the opportunity to analyse the quantitative data through a variety of statistical techniques. In addition, comparisons with other studies adopting similar methodological approach could be made.

Many writers, however, cited several drawbacks of postal questionnaires as a method of data collection. Luthans (1992) for instance, cited that the information obtained from the postal questionnaire survey lacks depth and the information only reflects perceptions of behaviour rather than the actual behaviour in the real setting. Others quote poor response rate, response bias, the wording of the questions, as well as the inability of the investigator to verify the information provided (Adams, 1956, Dillman, 1972, and Kerlinger, 1976). Moser and Kalton (1993), however, suggested a variety of techniques that could overcome the drawbacks. Each technique having the effect of increasing the response rate. The techniques will be explained in section 2.5.2 design and content of questionnaire and section 2.5.7 the administration of postal questionnaire survey.

#### 2.5.1 Refurbishment project parameters for the final postal questionnaire survey

The respondents were asked to select a completed refurbishment project carried out after December 1991 in which they were actively involved. The method of asking the respondent to select a past construction project by survey was also used by Laufer et al (1993, 1994). Faniran et al (1994) Naoum (1989) and Rawlinson (1988). Two further refurbishment project parameters were added i.e. that the procurement systems must be either traditional or design and build and the contract project value must be above £500,000.

The project size of contract value of more than £500,000 is slightly above the value of that Skitmore and Ashworth (1982) classified as large refurbishment projects. This is to ensure the refurbishment projects supplied by the respondent are of a high degree of complexity and uncertainty. Besides, Quah (1992) noted that the degree of



competition in bidding is significantly greater for refurbishment projects of contract value £500,000. Quah (1992) established this by using an analysis of variance (ANOVA) F test. The test showed that the population means of the two sub-groups of less than £100,000 and £100,000-£250,000 and the larger job size categories £500,000 and above, was significantly different. The implication is that regardless of project type, the degree of competition is more intense for the larger-sized projects because of increase in the number of bidders. This result is important to be considered in this study, as studies on construction projects have shown that the degree of competition at tender has a significant impact on project planning performance (Faniran et al 1994; Laufer et al 1991; Bromilow, 1971 and Ireland, 1985 ). Therefore it is important to keep the degree of competition constant to avoid it from influencing the measurement of the variables that this study intended to measure.

The author was, however, concerned that the criterion that the refurbishment projects to be selected must be after 31 December 1991. The inclusion of this criterion would tend to reduce the response rate since it limits the choice of the respondents. But the inclusion of this criterion was considered to be necessary, in order to ensure that only the most recent projects were chosen. The inclusion of this criterion would reduce the effects of variability in market conditions. Besides, accuracy in measurement could also be affected by memory lapse (Moser and Kalton, 1993).

### 2.5.2 Design and content of the questionnaire

The design of questionnaire for this study mostly follows the guidelines of Moser and Kalton (1971), Lewis and Fox (1969).

The questionnaire length is an important factor to be considered in the design of a postal questionnaire. Moser and Kalton (1971) warned of the temptation with

investigators involved in questionnaire construction and design to cover too much and to ask questions on everything that might turn out to be interesting.

Nevertheless, the evidence from the literature review suggested that the effect of questionnaire length on response rates have been mixed. Clausen and Ford (1947), Scott (1961) Kanuk and Berenson (1975) have shown that there is no correlation between questionnaire length and the lack of response. But Jobber (1985) emphasised that business managers work under time constraints, and any attempt to distract them from their business, would be viewed as an intrusion on their time, and likely to be resented.

Heberlein and Baumgarter (1978) and Forgren (1986) stated that the most important factor in ensuring high response rates, is whether the respondents perceive the survey as important and current to them, i.e. whether the respondents are interested in the subject of the survey. In addition, Forgsen (1986) also noted that a high response rate could be attained if the respondent is knowledgeable about the issues covered by the survey.

A balance was reached between obtaining as much information from the questionnaire in order to satisfy the objectives of the study and ensuring that an 'acceptable' response rate would be achieved. In the end, a postal questionnaire survey, 6 pages long, was considered to be sufficient and necessary to provide information for a rigorous statistical analysis.

It is also important for the questionnaire to have a layout which is suitable for respondents to rate themselves with speedy completion (Gael, 1983). Therefore, an open-ended question and answer approach was discounted.

The questions were listed to flow first from respondents' particulars, to refurbishment project characteristics, planning and control process, refurbishment project planning performance, and finally to the firms' organisation structure. This is to assist

respondents to channel and co-ordinate their thought in a systematic order. This design is to follow Schein's (1978) advice to avoid disjointed listing.

However, it must not be overlooked that, conditioning respondents' minds could pre-determine responses. Therefore, in a number of questions, the scales were reversed.

### 2.5.3 Pilot-questionnaire

Prior to sending the final draft to the target population, the questionnaire had to be piloted. An important part of the piloting process was to make sure the questions provided the needed data and to clarify ambiguity of wording.

Dillman (1978) recommends that pre-testing should include different groups, such as colleagues and potential users of the data. The initial draft of the questionnaire was presented to colleagues at the University College London, the author's supervisor, and a lecturer in the University of Derby, to invite comments and suggestions. The pilot questionnaires were then distributed to 4 potential users, i.e. planning and control managers involved in refurbishment projects. The 4 planning and control managers were employed in 4 different construction firms. They were chosen based on their experience and knowledge in the planning and control refurbishment projects. In order to remove bias, the planning and control managers who were involved in the pilot questionnaire were excluded from participating in the final postal questionnaire survey. Comments were made about the length, listing of questions, ambiguous words and the questionnaire format. Discussions were held separately with each of the persons mentioned. After limited modifications, 166 questionnaires were finally ready to be sent to planning and control managers of refurbishment projects.



#### 2.5.4 The population for the final postal questionnaire survey

Out of 103 construction firms who responded to the preliminary postal questionnaire survey, only 94 construction firms were selected for the final postal questionnaire survey. The other 9 construction firms were considered to be too small (annual turnover less one million pounds) therefore considered unlikely to undertake refurbishment projects of contract value in excess of half a million pounds.

From the semi-structured interview, it was discovered that the involvement of the planning and control managers varied from one refurbishment project stage to another. Site management, for example, is the dominant party during construction stage, but has minimum involvement during the pre-bid stage. On the other hand, planners and the contract management team (which includes contract manager, contract director and project manager and in smaller firms managing director are involved throughout the three refurbishment project stages. The involvement of managing directors throughout refurbishment project stages confirmed Egbu's (1994) study that managing director tend to be involved more in day-to-day running of refurbishment projects than new construction. Since the study is to cover all three refurbishment project stages, i.e. pre-bid, pre-construction and during construction, the sample population is planning and control managers involved in all refurbishment project stages, which comprises mainly planners and contract management.

The author discovered that in the majority of the construction firms that supplied their organisation charts they employ contract managers/directors and planners. However, 22 respondents in the preliminary postal questionnaire survey firms either did provide or returned incomplete organisation chart. They tended to be employed in smaller construction firms. Since smaller construction firms were considered to be less likely to employ planning specialist, the author only sent one questionnaire, addressed to the contract manager/directors to these 22 construction firms. In all, 94 contracts managers/directors and 72 planners were identified to be appropriate to answer to the final postal questionnaire.

#### 2.5.5 Administration of the final postal questionnaire survey

The final postal questionnaire distribution occurred in October 1995, four months after the completion the semi-structured interviews. Each questionnaire was accompanied by a letter of introduction from the author's supervisor, a covering letter and a reply envelope.

The author paid special attention to the suggestions made by several writers relating to the covering letter. Moser and Kalton (1993), Matteson (1974), Kerin and Harvey (1976) and Thompson (1984), have shown that semi-personalised covering letters containing individually typed personalised salutations and individually signed by the investigator increases questionnaire response rate. The author chose to individually hand-write the address, salutation and signature on each covering letter.

The author also explained in the covering letter the objectives and the benefits of the study. The reasons why the respondents were selected and chosen for the sample, and why they were qualified to supply the information required were also mentioned. These are the suggestions made by Linsky (1965) and Moser and Kalton (1993).

The response rate could further be increased by naming the sponsor, (Moser and Kalton, 1993; Scott, 1961 and Albaum, 1987) notification of deadline for receipt of completed questionnaire (Henley, 1976) and granting anonymity and confidentiality (Moser and Kalton, 1993; Futrell, 1981 and Futrell and Hise, 1982).

Moser and Kalton (1993) also suggested that a hand written note on the covering letter would also have the effect of increasing the response rate. The author took this suggestion.

To encourage reply, the author promised to send to the respondent a free copy of the summary of the results of the study, if the respondent was interested (Young, 1988 and Egbu, 1994).

A sample of the covering letter and the final postal questionnaire are shown in appendix K and L respectively.

After the third week, a short letter of reminder together with the original letter, a copy of the questionnaire and a reply envelope were distributed to the non-respondents. A copy of the reminder letter is shown in appendix M. The use of follow-up techniques have been widely accepted by researchers as having significant effects in improving response rate. (Moser and Kalton, 1993; Levine and Gordon, 1958; Bouchard, 1976). After 6 weeks 81 responses were received.

When more than one response was received from a construction firm, the author took a precautionary step to ensure that each refurbishment project or case provided was unique. Precautions were also taken to ensure that the questionnaires were completed by different persons. This was determined mostly, by comparing the reference number on the questionnaire, the name and job title of the respondents, the contract value, the project duration, the type of building, the procurement system and the date the project starts and the extension time. Of all 13 firms that returned two questionnaires, none was found to provide two identical projects or supplied by a single person. The majority, 41 firms returned only one questionnaire, either from a planner or from a contract manager. All the refurbishment projects included in the analysis were verified to be unique and supplied by different respondents.

In all, 81 questionnaires were returned, giving the rate of response of 49%. Out of this, 7 respondents cited that their firms did not undertake refurbishment projects that satisfy one or all the three refurbishment project criteria. Two managers notified by telephone that their firms also did not carry out refurbishment project as specified. One respondent mentioned that he had no experience in planning and control of a refurbishment project. One respondent cited that he could not fill the questionnaire because of his firm's policy of not participating in any research conducted by students.

Three returned questionnaires were considered out of scope. One manager gave a refurbishment project that took place between 1985-1991, thus violating one of the refurbishment projects' criteria. One manager gave a refurbishment project while working in a different firm. One reply was rejected because the respondent gave his job title as 'partner' which was considered to be out of scope.

Thus, only 67 (40%) questionnaires were considered to be useful for statistical analysis in this study.

#### 2.5.6 Factors that affect the rate of response

Table 2.2 shows the breakdown of the number of final postal questionnaires distributed and the rate of response, categorised based on the size of firms' annual turnover.

Table 2.2 The rate of response of the final postal questionnaire survey categorised under the construction firms' annual turnover

Firm annual turnover (mill.£)	Number of firm selected	Number of questionnaires distributed	Number of useful replies	the rate of response	% out of total response
1 - 10	41	57	16	28%	24%
11 - 100	41	85	41	48%	61%
>101	12	24	10	42%	15%
Total	94	166	67	40%	100%

Table 2.2 shows that the rate of response is lowest from the construction firms in the smallest category, i.e. those with annual turnover between £1-£10 million. All the seven respondents who cited that their construction firms did not carry refurbishment project in excess of half million pounds were employed in construction firms in this category.

Thus the rate of response could be attributed to the fact that many construction firms with annual turnover of less than £10 million pounds did not undertake refurbishment projects of more than half million pounds. It is also highly probable that due to the lack of resources, the smaller construction firms were less inclined to participate in this study.

## 2.6 Data transformation

For this study, the Statistical Package for the Social Sciences (SPSS for Windows Version 6.1) was used for data transformation and analysis. The results are either presented in tabular format that include summary statistics or in the form of charts.

### 2.6.1 Frequency distributions and descriptive statistics

Frequency distributions and descriptive statistics are used to show the general trends in the project complexity and uncertainty, the extent the co-ordination devices used and planning performance scores. The results are presented in graphical and tabular forms.

### 2.6.2 Bivariate analysis

Bivariate analysis is used to enable the author to quantify the strength and nature of relationships between two sets of variable, for example between the project uncertainty variables and planning performance variables.

Two bivariate correlation techniques are used: -

a) Spearman's correlation coefficient technique:

The Spearman's correlation coefficient technique is a non-parametric technique used to measure the relationships between two ordinal variables. The advantage of using Spearman's correlation coefficient is that it does not need the normality assumption in order to use it.

b) Kendall's Tau-b correlation coefficient technique:

It is used to measure the association between ordinal and nominal (dichotomous variables). An example of when this technique was used is to establish the association between the procurement systems (nominal scale) and the refurbishment projects contract value (ordinal scale).

For both correlation techniques, 5% level of significant was used to reject the null hypotheses.

### 2.6.3 Multivariate analysis

It is a technique closely related to multiple linear regression. It provides a single measure of linear association between two variables while adjusting for the linear effects of one or more additional variables. The partial correlation techniques is used to uncover spurious relationships, identifying intervening variables, and detecting hidden relationships.

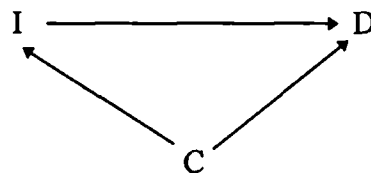
Partial correlation multivariate technique has been utilised in this study. By applying this correlation technique in the study the effect of a contingent variable (C) on the

relationship between independent variable (I) and the dependent variable (D). The extent to which relationship I - D may be caused by C can be revealed. It should be highlighted here that theoretically, two explanations could be given to the possible role of C. The first role of intervening variable, as indicated by the diagram below;



If the partial correlation  $r_{id.c}$  drops, it can be concluded that no true relationship between I and D exists, but that an indirect correlation is caused by I having effect on C and C on D.

The second role C is as an antecedent variable, as indicated by the next diagram;



a spurious correlation between I and D. The technique of partial correlation does not distinguish between both models. Theoretical reasoning should determine which of the two models is more relevant in each particular case.

#### 2.6.4 Kruskal-Wallis test

Kruskal-Wallis is a non-parametric test. It is used to detect the differences of the mean between different groups of population. An example when the Kruskal-Wallis test was used in this study is to find the differences in the difficulty of access to project sites and between different types of refurbishment projects (residential, office, school and hospital).

## 2.7 The theoretical framework

The theoretical framework of this study is described on page 306 to 311. The main hypotheses listed on page 29 were formulated from the theoretical framework. Appendix T summarises the results of the hypothesis tests. The author suggests that the reader use the theoretical framework as a guide to follow the arguments presented in the rest of this thesis.

## 2.8 Summary

This chapter attempts to describe in detail the methodological procedure used in the study. The three stage procedure comprises the preliminary postal questionnaire survey that resulted in 103(37%) response rate, 15 semi-structured interviews with planning and control managers from 15 construction firms and the final postal questionnaire survey that yielded 67(40%) rate of response.

The interrelated aspects of the survey, the mechanisms, the reasons and limitations of each stage of the methodology have been discussed. And lastly the statistical techniques and measures chosen for data analysis were also presented.

Despite the various problems encountered from the outset, especially the non-existence of any official directory on refurbishment construction firms and on refurbishment projects, through the three stage procedure, the author managed to obtain sufficient number of respondents to enable the author to perform a rigorous statistical analysis.

This methodology may be especially useful for further research on construction projects that encounter the problems of the lack of secondary data and of identifying the target population.



## **Chapter 3**

### **Refurbishment: growth and planning performance**

#### **3.0 Introduction**

There is no standard definition of refurbishment. The Chartered Institute of Building (1987) defines refurbishment as the alteration of an existing building designed to improve the facilities, rearrange internal areas and/or increase the structural life span without changing the original function.

Marsh (1983: p. 3), however, defines refurbishment as making use of what is usable in the ageing building stock, the skilful adaptation of building shells (which is valuable in its own right and not due to any historic mystique) to a new or an updated version of its existing use - if the opportunity is taken to upgrade the accommodation significantly, the project passes into the realms of refurbishment. This definition differs from the CIOB definition in that even a change in original function is also considered as refurbishment.

Young and Egbu (1994) define refurbishment to cover a wider scope of work, not limited to alteration and adaptation as defined by the CIOB (1987) and Marsh (1983). Young and Egbu's (1994) definition also includes renovation rehabilitation, extension, improvement, conversion, modernisation, fitting out and repair which is undertaken on an existing building to permit its reuse for various specified purposes. This definition does not include repair and maintenance, which is normally carried out on a continuing routine basis to upkeep buildings to an acceptable standard and consists of work such as daily cleaning, periodic painting or other emergency work. Due to its comprehensiveness and clarity, this definition is used for the purpose of this study.

Literature review also reveals that, like the definition for refurbishment, there are various definitions of project. In 1983, the Project Management Institute (PMI), USA, for example defines a project as any undertaking with a defined starting point and defined objectives by which completion is identified. In practice, most projects depend on finite or limited resources by which the objectives are to be accomplished (The PMI handbook, 1983: p. 4). Eleven years later, the PMI changed its project definition to 'a temporary undertaking to create a unique product or service. (The Journal of Project Management, March 1996: p. 13).

Bennett (1988) on the other hand, includes a management function, i.e. co-ordination in his project definition. He defines a project as consciously co-ordinated actions of two or more persons or teams aimed at discrete objectives.

Bennett's (1988) definition, however, fails to reflect the major characteristics of construction projects. One of the major characteristics of construction projects according to Kingdon (1973) is a high degree of complexity, where inputs (e.g. raw materials) may be diverse and non-uniform and in which a large number of specialist contributors are required to perform the tasks and production processes lacking in standardisation and routine, and where feedback loops within the production systems itself may be extensive. Under these conditions, task boundaries are not well defined. Kingdon (1973) argued that the greater the need for self-regulation and material adjustments, the wider the spread of discretionary authority and the greater the need for direct interaction between subgroups. When the need for self-regulation is great, the effectiveness of bureaucratic organisation is limited.

Woodward (1965) on the other hand, describes construction project as small batch production, with production ranging from one-off to tens of identical units. Such production according to her develops a level of uncertainty, in which the amount of information possessed by the planners is less than the information needed to perform the tasks (Galbraith, 1977). Uncertainty generates by learning curve problems. By the

time these problems are solved, the project has ended and not all the expertise gained is transferable to another project.

There is a consensus among many writers that refurbishment projects are among the most complex and uncertain of all construction projects (Quah, 1992; Boyd and Weaver, 1994; Okoroh, 1994; BRE, 1990 and Young and Egbu, 1994). Therefore the most appropriate definition for refurbishment project would be: a refurbishment undertaking of varying degree of complexity and uncertainty that involves the integration across organisational boundaries of groups, departments and organisational units and companies aimed at discrete objectives.

The non-existence of official statistics on the actual value of refurbishment work in the United Kingdom makes it difficult to ascertain the importance of refurbishment in construction sector. The Department of Environment (DoE) statistics on the repair and maintenance sector are generally accepted and used by practitioners, government establishments and academics as the basis for monitoring trends in the refurbishment sector.

The DoE (1996) statistics shows that repair and maintenance, including housing improvement work, has grown in importance to the construction industry over a long period of time. In 1995, it accounted for over 40% of the total volume of the construction industry's output, thus becoming an important sector of the construction industry in the UK.

There are many factors, as will be discussed in section 3.1 that contribute to the growth of refurbishment projects. The main concern here is that the continued acceptance of refurbishment as a viable economic option in providing comfortable accommodation, is more likely to be hindered by the general perception that it is risky and uncertain, reflected in the tendency of many refurbishment projects to exceed the target cost and time. This needs to be rectified.

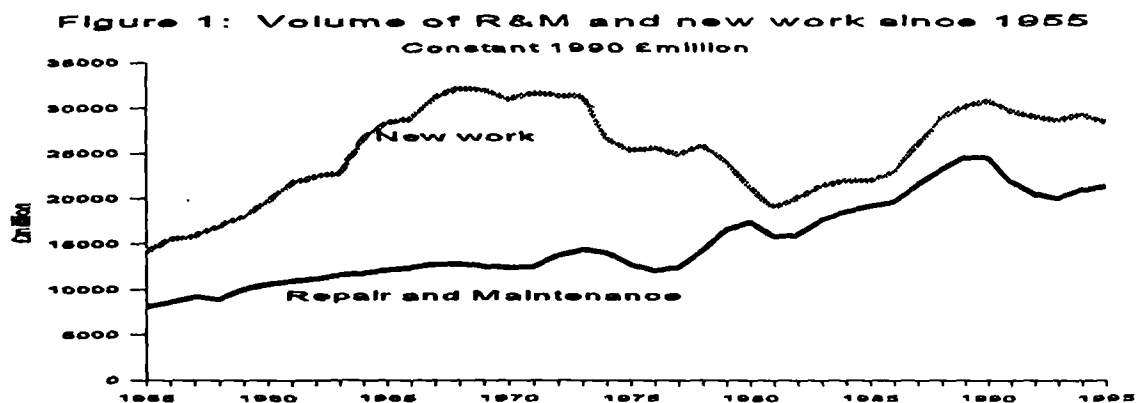
The main objectives of this chapter are: –

1. To highlight the factors that affect the growth of the refurbishment sector.
2. To highlight the factors that affect the planning performance of refurbishment work.

### 3.1 Factors influencing the growth of refurbishment projects

Figure 3.1 shows the relative levels of repair and maintenance and new work output since 1955. New work output has doubled since 1955. The repair and maintenance, however, has grown more rapidly and in 1995 and was around 2½ times its level in 1955 and has shown a much lesser swing in volume than new work.

Figure 3.1 Volume of repair and maintenance and new work since 1955

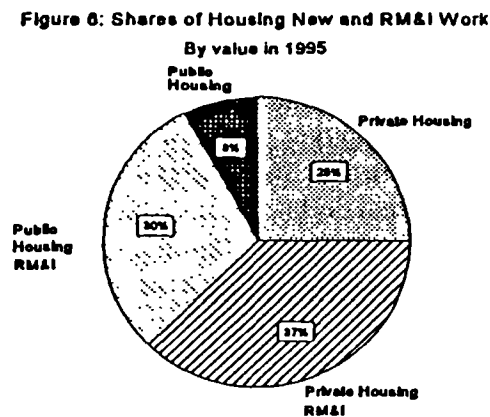


Source: Consultative Committee on Construction Industry Statistics (CCIS, 1996), 'The State of Construction Industry' A report jointly prepared by the Department of Environment and representatives of the construction industry, July 1996

The refurbishment of a building may be initiated for various reasons. Flanagan et al (1989) includes physical deterioration and obsolescence as the major reasons for refurbishment. The factors that contribute to obsolescence are functional, technological, social, locational, legal, aesthetic and visual (fashion/image) and environmental obsolescence. Similar lists, with slightly differing points of view are also presented by Young et al (1996) and Marsh (1983).

The housing sector is the major contributor of repair and maintenance work. In fact, as shown in figure 3.2, the total work by value in 1995 of the housing sector constitutes nearly 70% repair and maintenance work in the United Kingdom and a significant proportion will be refurbishment proper.

Figure 3.2 Shares of housing: new and repair maintenance work by value in 1995



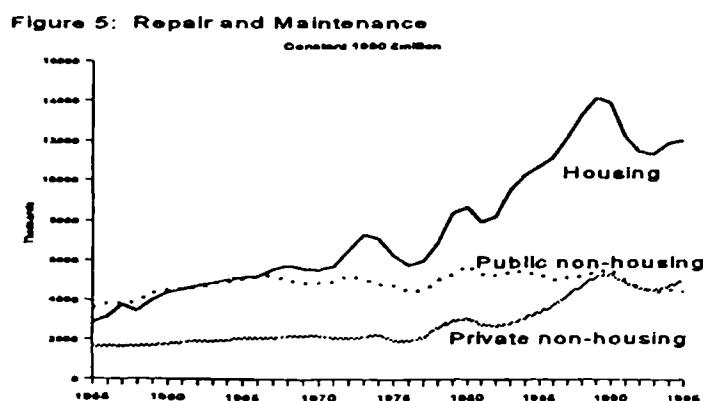
*Source: Consultative Committee on Construction Industry Statistics (CCIS, 1996), 'The State of Construction Industry' A report jointly prepared by the Department of Environment and representatives of the construction industry, July 1996.*

The English Housing Condition Survey (DoE, 1988) indicated that in 1986, of the 18.8 million dwellings in England, there were 1.05 million dwellings unfit to live in, 0.54 dwellings lack basic amenities and 1.1 million having 'serious' disrepair. Thomas and Archer (1989) estimated that these conditions require investment in the range of £18 to £30 billion. Marsh (1983) highlighted that many of those buildings needed modification of structures to improve weather exclusion, acoustic and thermal performance.

Hillebrandt (1984) observed that many buildings, especially those in the inner cities have been under-utilised, wrongly utilised or have become dilapidated. Consequently, the buildings and the run-down areas tend to generate social problems, such as vandalism and graffiti. This has led both the government and the private sector to embark on new refurbishment initiatives to tackle the problem.

The declining conditions of industrial and other commercial buildings, have also exerted pressures on both government and building owners to carry out refurbishment projects. In fact, in non-housing, especially in the public sector, the rate of increase has been strong since 1975 and reaches its peak in the first quarter of 1996. (See figure 3.3).

Figure 3.3 The trends of repair maintenance in housing and non-housing sectors

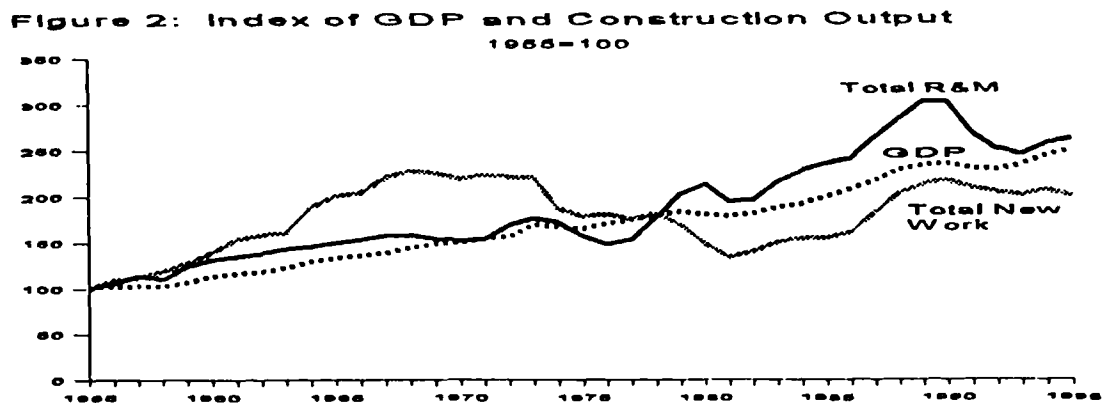


Source: Consultative Committee on Construction Industry Statistics (CCIS, 1996)

Financial pressures brought about by the recession and a recognition of the value of existing building stock as an asset make the refurbishment option becomes more viable (Boyd, 1983 and DoE, 1987).

Young et al (1996) maintained that during recession, there is an added need for the conservation of resources. This means that vacant building stock will have to be re-used. Recession times in the 1970s and early 1990s forced the government to curtail expenditure on new programmes. This is reflected in the declining trend of output of new work with corresponding increase in repair and maintenance work from 1973 to 1985 (see figure 3.4). Also, the CCCIS (1996) reveals that new work output fell by 3% in 1995 compared to 1994 and by 2% in the first quarter of 1996 compared to the previous quarter. Repair and maintenance output, by contrast, grew by 2% in 1995, and showed a further increase in the first quarter of 1996.

Figure 3.4 Index of GDP and construction output



Source: Consultative Committee on Construction Industry Statistics (CCIS, 1996),  
The State of Construction Industry: A report jointly prepared by the Department of  
Environment and representatives of the construction industry, July 1996

In addition, the shortages of land (Turner, 1987) and the explosion in land prices (Robinson, 1987) especially in the South East of England, during the mid-late 1980s, also increased the demand for refurbished buildings.

Technological change shortens the functional life of buildings at an increasing rate and will require modernisation of buildings, especially their services.

The greater complexity of equipment, such as office automation and computerisation and electronic equipment requires different accommodation (Marsh, 1983; Boyd and Weaver, 1994 and Young et al, 1996). Young et al (1996) further added that the advent of intelligent buildings and the employment of facilities managers encourage property owners to refurbish their properties to accommodate end users needs.

Office buildings of the 1960s and 1970s in comparison with modern buildings, do not provide adequate floor to ceiling heights (IMR, 1987), an important provision before modern electronic equipment and communication systems could be accommodated. This forced property owners to refurbish their buildings.

A growing environmental awareness that refurbishment could save natural resources has fuelled further demand for refurbishment projects. The pressures from social and preservationist groups such as SAVE Britain's Heritage (Young et al, 1996) and English Heritage (Catt, 1992) which are in favour of maintaining and keeping communities together instead of slum clearance, has also contributed to the growing demand for refurbishment.

The gradual decline in average household size in the United Kingdom (Fleming and Nellis, 1992) has fuelled the conversion of larger houses into smaller units, thereby increasing residential refurbishment (Young et al, 1996).

Marsh (1993) noted that sheer commercial competition, either for a better quality workspace for staff or to improve image due to changing taste and fashion has led many developers and investors to upgrade and modernise their premises.



Many buildings of architectural and historical value are listed. These buildings are only permitted to be refurbished and upgraded and not redeveloped. In addition, most older buildings have higher plot ratio than new buildings (Highfield, 1987). Applications of plot ratio control and the restriction of new developments favour refurbishment and rehabilitation work. Also, in some cases, the sheer difficulty in obtaining planning consent will push developers and investors towards refurbishment rather than redevelopment (Young et al, 1996).

In order to meet the building regulations concerning means of escape and other fire safety regulations, access, ventilation, energy conservation and the use of acceptable building materials, results in many buildings, especially those built in the 1950s, 1960s and 1970s to be refurbished. (Marsh, 1983 and Young et al, 1996). Marsh (1983) further added that pressures from insurance agents was also one of the important factors that initiated refurbishment work. This was as a result of refusal by insurance agents to insure on safety grounds.

Aikivuori (1996) conducted a study in Finland to determine, quantitatively, the most important factors that contribute to increased demand for refurbishment projects. The factors are classified into five categories, i.e. failure in building due to deterioration, optimisation of economical factors, change in use, change in circumstances and subjective features of the decision-maker. The study discovered that nearly half of the refurbishment projects were initiated due to subjective features of the decision-maker i.e. to add comfort and to improve the appearance of a building. More than a quarter were refurbished because of change of use. Refurbishment due to deterioration constitutes less than a fifth of all refurbishment project being carried out.

What is interesting to note is that, the average period of use before refurbishment that derived from the subjective features of decision-makers was only 17.7 years. In contrast, the average periods of use before refurbishment that derived from the change of use and deterioration were 26.8 and 28.7 years respectively.

Because deterioration constitutes less than a fifth of all refurbishment projects, this implies that most buildings being refurbished were still structurally sound. It could

also be interpreted that it is technological and social change that initiates the majority of refurbishment work, resulting in shortened periods of use of buildings.

This augurs well for the refurbishment sector. Shortened period of use of buildings would result in the buildings needing to be refurbished more frequently. Thus it is expected that the refurbishment sector will continue to increase, mainly because of rapid technological change. Unfortunately, literature review reveals that there are no similar studies being conducted in the U.K to determine the contributions of the factors towards refurbishment work in the United Kingdom. Thus, comparisons with Aikivuori's (1996) study could not be made.

Most certainly, the demand for refurbishment would be reduced if it persistently shows low level of performance. Section 3.2 will examine the planning performance areas that need improvement in refurbishment projects.

### 3.2 Refurbishment planning performance

The Latham Report (1994) titled 'Constructing the Team' proposed that the government and the construction industry should accept a target for real cost reduction of 30% by the year 2000. The means of achieving this target is not about reducing fees or tender prices, but about changing the processes of design and construction.

There has been intense debate whether the 30% could be achieved. Many clients' representatives, such as, the BAA plc Chief Executive Sir John Egan maintain that the cost reduction should be 50%. Those who are involved in refurbishment, however, would argue that cost reduction of 30% would be difficult to achieve, without improving the performance of the refurbishment sector, which constitutes more than 40% of construction industry. In addition, the inherent uncertainty of refurbishment makes it difficult to set any meaningful target. The management areas in refurbishment that need improvement are still not well researched.

The contractors' practice of documenting the relevant project information requires thorough examination to monitor and assess the extent of targets that are achieved. Young et al (1996), for instance, maintain that most contractors do not document the relevant information for such estimation. Where such information does exist, there is the problem of inherent differences in the way different contractors collate such information, making a comparative analysis difficult.

Bennett (1994) who was instrumental in setting the 30% target, however, sees no quick fixes. According to him, there is no great secret, but only hard work and a totally professional approach, which has to be sustained over many years.

The difficulty in setting performance targets is reflected in the level of planning performance of refurbishment projects. Planning performance has been measured in terms of cost variance (Faniran et al, 1994 and Emery, 1969) time variance, quality of workmanship, suitability for user, aesthetic contribution to the environment, satisfaction of client with the final building quality (Ireland, 1985; Faniran et al, 1994; Ramanujam et al, 1986 and Arditi and Koseoglu, 1983) man-hour variance and extent of use of plans (Laufer and Cohenca, 1990).

The complexity and uncertainty of refurbishment projects may tempt refurbishment contractors to keep the primary objectives of cost, time and functional performance flexible and allowed to be evolved during the project. The concept of evolution of objectives may be perceived as a proper and necessary process of refurbishment projects, especially where the end use is uncertain at the outset. The client must be prepared to accept the time and cost variations that this will impose. This is certainly an unacceptable concept to many clients, as it will leave them in a state of uncertainty, and will discourage them from undertaking refurbishment work.

Ideally, clear objectives are set early in the project, prioritise them and hold them firm through the project. Where this is not possible, the project must be organised in a way which will be able to cope with project uncertainty.

The CIRIA (1994) maintains that conflicting objectives is one of the most important problems connected with refurbishment projects. The basic objectives of cost, time and quality which are present in all projects are often supplemented on refurbishment projects by major objectives such as minimal disruption to the operation of the building, safety, continuing operation or occupancy by the 'user' client may all hinder the achievement of speedy construction which is the priority of the 'owner' client. These objectives are the secondary objectives, although they may in fact come to dominate the refurbishment projects. The more easily quantifiable primary objectives of cost, time and quality tend to be overlooked.

This chapter seeks to establish and discuss the implications of the level of planning performance of refurbishment projects based on four planning performance criteria, i.e. cost variance, time variance, quality of workmanship and the extent to which the planning techniques are used for monitoring during construction.

Laufer and Cohenca (1990) in their study titled 'Factors affecting construction planning outcomes' proposed a model project with four fixed and eight variable characteristics. The fixed characteristics refer to the following (1) Type of contract: lump sum (2) Cost of construction: \$20 million; (3) duration of project: 18 months and (4) type of construction to be selected by each participant.

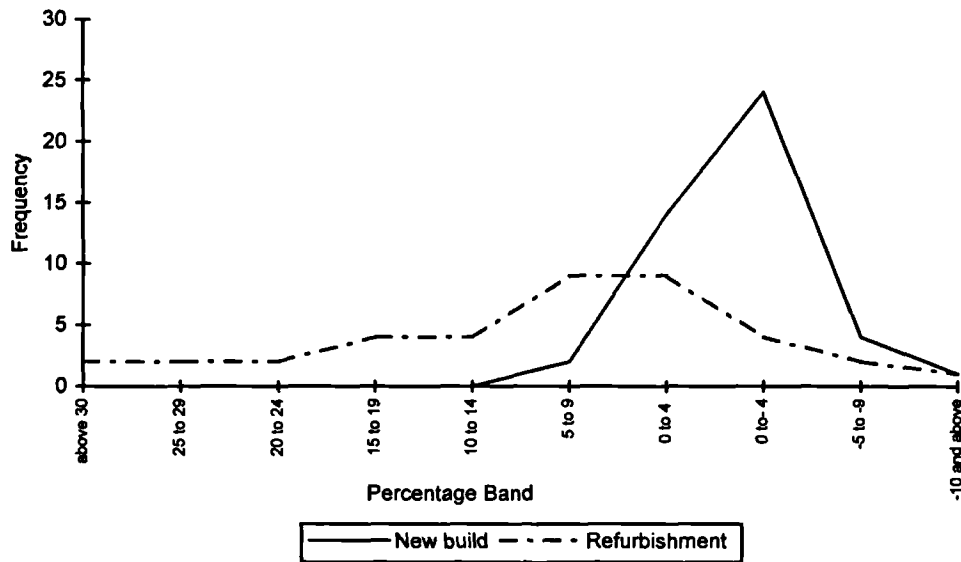
The variable characteristics were grouped under three project dimensions: project complexity, project uncertainty and attitudes towards planning. The variables measured under project complexity are the number of subcontractors, the number of construction trades and objectives rigidity. For project uncertainty, the four variable characteristics are percentage completion of design, past construction experience, weather predictability and availability of skilled labour in the vicinity of the project.

From the analysis of 72 construction projects obtained by means of mailed questionnaire to top 400 construction firms in the United States, Laufer and Cohenca (1990) found that the most important factors affecting construction planning outcomes were the percentage completion of design, past construction experience, labour supply, weather predictability and attitudes towards planning.

The major implication of Laufer and Cohenca's (1990) results is that planning performance is affected not only by the complexity and uncertainty of the construction projects, but also the input of the project organisations. In other words, the effects of complexity and uncertainty upon construction could be moderated by the project organisations.

Weaver (1993) compared the cost variance between 42 refurbishment and 41 new build projects. Cost variance refers to the extent to which the planned cost corresponds to the actual cost. The tender price was used to indicate the planned cost. The final account figure was used to indicate the actual cost. The final account figure includes variations, extra remedial work, prolongation and disruption costs. The results are shown in figure 3.5.

Figure 3.5 Frequency of differences between final account and tender costs for new and refurbishment projects



Source: Boyd and Weaver (1994): *Improving the management and operations of refurbishment projects, the Vol 1, the Tenth ARCOM Annual Conference, 1994, September 14-16, Loughbrough University, UK.*

Figure 3.5 shows that there is a greater variation in cost variance in refurbishment projects than new build. In refurbishment projects, the difference between the target and actual prices range from above +34% to -10%. In new build projects, the differences range from +7% to -13%. In addition, more than 50% of refurbishment projects exceeded the tender cost by greater than 5%, compared to less than 5% for new build. This shows that the majority of refurbishment projects go significantly over budget. It is these differences that induce the feeling of uncertainty and high risk in refurbishment that feed back onto the tender bids.

From the analysis of the final account of eight refurbishment projects, Boyd and Weaver (1994) found that one project overspend because of a change in specification in cladding. Five projects required extended contract periods due to additional works, which comprised largely of additional repairs and replacement of fabrics, finishes or services to the building. One project underspent because work was transferred to a

later phase. From these results, it could be concluded that there is tendency to underestimate the problems in refurbishment projects and the final account costs frequently exceed beyond original estimates.

Similar results were also found in the present study. The respondents to the final postal questionnaire survey were asked to indicate the cost variance of the refurbishment projects, measured in terms of the ratio of actual construction cost to target construction cost. The exact wording and measurements for the cost variance is shown in appendix L.

The results are shown in tables 3.1. The cost variance of less than 1 means that the actual construction cost is less than the target construction cost. The cost variance of more than 1 means that the actual construction cost is more than the target construction cost.

Table 3.1 The cost variance of refurbishment projects

Cost variance	Refurbishment projects (N=60) %
Less than 0.90	23.3
0.91 to 0.95	8.3
1.01 -1.05	15.0
0.96 -1.00	18.3
1.06 -1.10	21.7
More than 1.10	13.3

Table 3.1 shows that in 53.3% refurbishment projects, the cost variance is more than 1, which indicates that in more than half of the refurbishment projects, the actual cost exceeded the target cost. It is also alarming to note that in 35.0 % of the refurbishment projects, the actual cost exceeded the target cost by more than 5%.

This result implies that there is a need to make accurate estimates and monitor the cost performance of refurbishment projects. Managing uncertainty is definitely a critical factor in refurbishment. There is a need for thorough building surveying and investigation. This will more likely reduce design changes during construction of refurbishment projects. The selection of an appropriate procurement system which allow the contractors to be actively involved in the building surveying investigation and to gather more information may reduce the level of uncertainty during construction stage.

There is also a need to increase the information processing capacity in the refurbishment project organisations during construction. This will help the participants employed in the organisations to respond quickly to changes occurring during construction. Systematic and efficient cost information flow is vital during the construction stage. This implies that a higher input from the cost controller or estimator may be required during construction stage. The cost controller or estimator needs to have site experience and understanding of refurbishment projects.

Increase in cost is normally associated with increase in time. In this study, the respondents to the final postal questionnaire survey were asked to indicate the time variance the refurbishment projects. The time variance is measured in terms of the ratio of the actual construction time to target construction time as stipulated in the contract document. The Spearman's correlation technique was employed in this study to detect the relationship between cost variance and time variance. It was found that cost variance and time variance were correlated (coefficient of 0.53 at 0.01 significant level) This result gives a strong indication of the validity of the data provided in this study.

From the final postal questionnaires, the respondents were asked to indicate the time variance of the refurbishment projects. As table 3.2 shows, only 47.5% of the refurbishment projects could be completed within the target time (when the time variance is 1 or less). Like the cost variance, more than 30% of the refurbishment projects exceeded the target time by more than 5%.



Table 3.2 The time variance of refurbishment projects

The time variance	Refurbishment projects (N=63)%
Less than 0.90	9.5
0.91 - 0.95	6.3
0.96 -1.00	31.7
1.01 - 1.05	22.2
1.06 - 1.10	16.0
More than 1.10	14.3

Quah (1992) maintains that the uncertainty of refurbishment work means that decisions are made based on intuition rather than systematic procedures. This could lead to difficulty in implementing performance targets. According to Boyd and Weaver (1994), the greater the uncertainty in refurbishment projects, the more difficult it is to predict the performance of refurbishment projects.

The result implies that close and systematic monitoring is vital to reduce time variance in refurbishment projects. This may require the employment of planning and control procedures and detailed plans, which enable deviations in the project progress to be detected. There is also a need to increase the speed of response from the key participants involved in the planning and control process, which requires both formal and informal interactions.

The extent to which prepared project plans are used for decision-making/monitoring is another measure of planning performance. A brief explanation on the types of plans used in refurbishment projects is discussed here.

In order to cope with uncertainty and to ensure cost and time targets are achieved, refurbishment project organisations need to prepare and use a variety of plans. From the semi-structured interviews conducted in this study, it was found that the method

statement, planning techniques, short-term plans and site layout were the most extensively used plans in refurbishment projects. By using these plans, the resources and the progress of the refurbishment projects could be controlled.

The method statement is used as the basis for estimating and as evidence to recover expenses on measured items or preliminaries. The method statement shows expenses of items, such as scaffolding and site installations. These costs are only recoverable by allowance. The method statement, which is prepared during pre-bid stage and continuously updated throughout a construction project life, is used for those purposes.

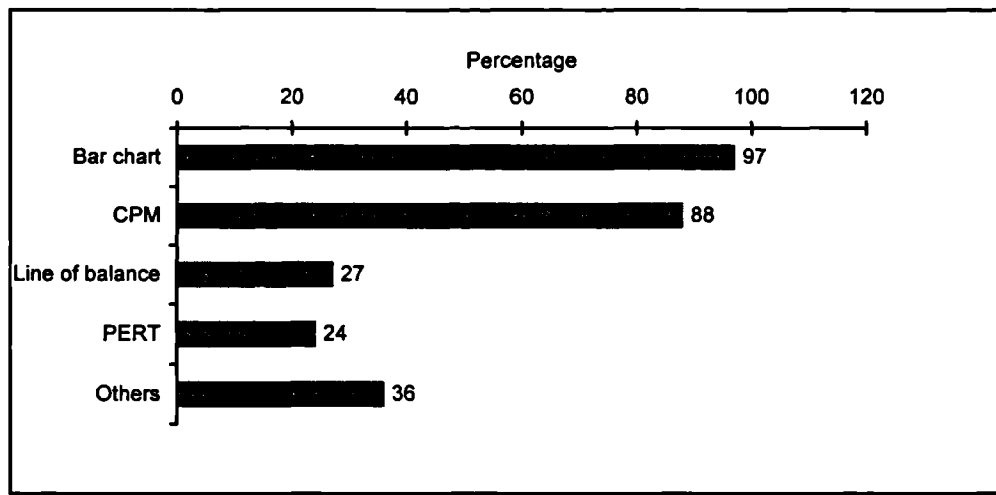
In conjunction with method statement, the project organisations also prepare and use planning techniques which aims to show the relationship between an activity and the preceding and succeeding activities. From the planning techniques, the resources required can be calculated. Without a programme of work, in the form of planning techniques which specify the time and resources allocation, the execution of the contract will be haphazard and disordered.

The most common planning techniques are bar chart, critical path method, precedence diagram and line of balance. The bar chart is the best known of all planning techniques.

Aouad and Price (1994) in their study titled, 'Construction plans and information in the UK and US construction industries: a comparative study', surveyed the top 100 construction firms in the UK on the types of planning techniques used by construction firms in construction projects. Thirty-three construction firms responded to their survey. The result is shown in figure 3.6. As figure 3.6 shows, the bar chart is the most popular planning technique, followed by the Critical Path Method (CPM).

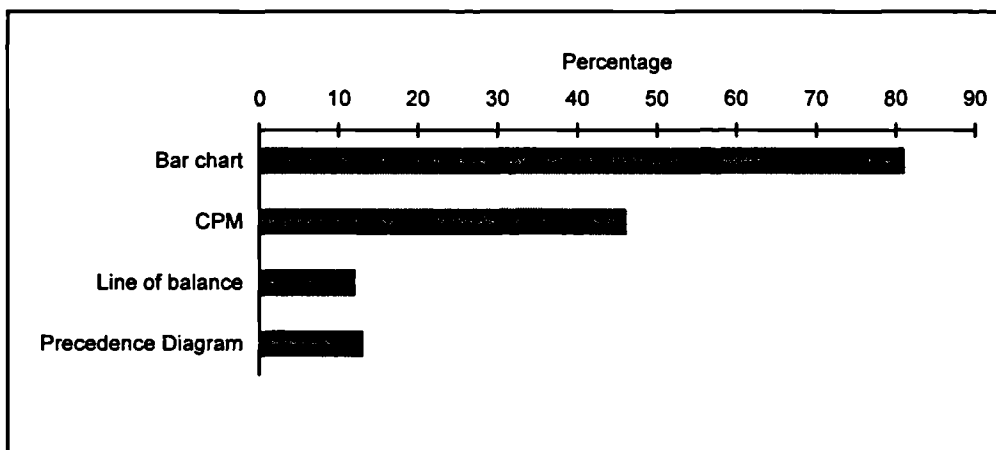
This study's finding is similar. In the preliminary postal questionnaire survey, the respondents were asked to indicate the types of planning techniques used in refurbishment projects. The result is shown in figure 3.7. The bar chart is the most popular among the 103 construction firms that responded to the survey, followed by the CPM.

Figure 3.6 The planning techniques used by contractors in the UK



*Source: Aouad, G. And Price, D.F, (1994) Construction planning and information technology in UK and US construction industries: a comparative study: Construction Management and Economics, 12, 97-106 E. & F.N. Spon.*

Figure 3.7 The planning techniques used by refurbishment contractors



It is interesting to note that the use of CPM and line of balance are much lower in the present study than found in the Aouad and Price (1994) study. It should be reminded here that Aouad and Price's (1994) sample population comprised the top 100 construction firms in the UK whereas in this study's the population sample comprises of both medium and large construction firms operating in the South east of England. The construction firms surveyed by Aouad and Price (1994) tend to be larger than the present study. This implies that the type of planning techniques used depends on the size of construction firms. The result also supports Young et al's (1996) observation that the use of planning techniques is determined by the acceptance by all levels of management within the firm.

Kendall's tau-b correlation technique was used in this study to establish the association between the use of CPM and the size of the construction firms. It was found that the use of CPM was significantly associated with the size of the construction firms (correlation coefficient of 0.33 at 0.01 significant level). Similarly, the use of line of balance tends to increase with increase construction firms' size (correlation value of 0.25 at 0.05 significant level). It appears that bigger construction firms tend to use more sophisticated planning techniques. This could be attributed to the fact that the knowledge of the personnel employed in larger construction firms on the planning techniques tends to be higher because of the presence of training department in many large construction firms.

Young et al (1996) observed that the utilisation and adoption of a planning technique was also dependent upon the type and range of projects undertaken. Young et al (1996) also showed that schedules and bar charts are the two most frequently used planning techniques in both the ship refurbishment and construction sectors.

From the semi-structured interviews conducted by the author, it was found that the popularity of bar chart in refurbishment projects is mostly attributed to its flexibility. All planning and control managers interviewed concurred that refurbishment work suffer from a higher degree of variation, and a higher element of uncertainty, and that they require a planning technique which could be produced and revised speedily. Besides, bar charts require relatively low levels of knowledge and skill to understand.

It could be argued that the greater uncertainty, the less accurate the planning techniques, hence the less the extent to which the planning techniques are used for monitoring. Laufer and Tucker (1988) inform us that the greater the uncertainty, the lower the accuracy, and the less the extent to which plans materialise. Boyd and Weaver (1994) maintain that the constraints imposed by the building to be refurbished, such as space and occupancy, make it difficult to conduct full investigation prior to commencement or work on site. Arguably, this could lead to poor design documentation which in turn leads to greater changes made in design. This is reflected in the lesser extent to which the planning techniques are used for monitoring.

The result obtained in the final postal questionnaire survey, however proved to be otherwise. The respondents were asked to indicate the extent to which the planning techniques were used for monitoring during construction stage (For the exact wording and measurement, see appendix L). The result is shown in Table 3.3.

Table 3.3 The extent to which the planning techniques were used for monitoring during construction

The extent of use.	Refurbishment projects (N=67) %
Small extent	9.0
Neutral	11.9
Large extent	79.1

Table 3.3 shows that the planning techniques prepared for the refurbishment projects are extensively used for monitoring. In 79% of refurbishment project, the planning techniques are used for monitoring to large extent. This is more than eight times the number than those with small extent.

A similar result was found by Young et al (1996) in their study titled 'Managing refurbishment works in the construction and shipping industries'. However, instead of measuring the extent to which the planning techniques were used for monitoring during

construction, Young et al (1996) compared the extent to which prepared project plans, which include planning techniques, were used in the process of decision-making during construction for construction and shipping refurbishment sectors. The responses of the personnel in Young et al's (1996) study are presented in table 3.4.

Table 3.4 The extent of use of prepared project plans in decision-making

Extent of use	Construction refurbishment (N=11) %	Ship refurbishment (N=26) %
Not used at all	0.0	0.0
Low level of use	18.2	3.8
A high level of use	63.6	76.9
A very high level of use	18.2	19.2

*Source: Young, B.A, Torrance, V.B. and Egbu, C.O. (1996) Managing refurbishment works in the construction and shipping industries, The Bartlett, University College London.*

As table 3.4 shows, there is relatively higher percentage of respondents from the ship sector (96.1%) who noted that there was high/very high extent of use of plans in decision-making, compared to respondents from construction refurbishment (81.8%). Young et al (1996) viewed that the programmes and planning of work in the ship refurbishment are marginally more accurate than in construction, hence a greater reliance on their use for decision-making.

The result implies that planning techniques are important tools in the planning and control process of refurbishment projects. Most likely, the effectiveness of planning techniques as planning and control tools are influenced more by the efforts of narrowing uncertainty by gathering more information. These efforts are reflected in the degree of detail of the planning techniques.

MacCrimmon and Taylor (1976) observed that although the interdependence between planning accuracy and the extent of uncertainty is recognised by most professionals in construction, they are seldom tackled integrally. This often leads to the practice of two extremes. That people averse to uncertainty delay decision-making to the limit, whereas

those who value the leverage of influence attempt to maintain a long planning horizon by greater investment in planning. In the later approach, more sophisticated computer techniques, extensive data gathering and analysis and generally more resources are required. As a result, updating response time increases rapidly (Mason, 1984) which disqualifies planning for real time decision-making, making it useful at best for forecasting.

In general, the refurbishment project organisations employ both strategies, i.e. narrowing uncertainty by gathering more information at the early stage of refurbishment projects and deferring and splitting decisions as much as possible until the information is more stable.

CIRIA (1994) maintains that refurbishment projects are characterised by extremely detailed programmes and resources lists, with a level of detail almost never found in new work. This was confirmed during the semi-structured interviews. The majority of the planning and control managers insisted that the degree of detail of planning techniques in refurbishment tended to be higher than in new build.

The degree of detail of planning techniques reflects the amount of information gathered and analysed and decisions made by the refurbishment project organisations in the refurbishment projects. The ability to gather and analyse information and make decisions on the planning techniques depends on the refurbishment project stages. From the semi-structured interview conducted in the present study, it was found that there are three distinctive refurbishment project stages, the pre-bid, pre-construction and during construction. They are briefly described below :-

1. Pre-bid stage: The stage prior to the submission of bid. The duration of pre-bid planning varies widely from several weeks to several months, depending on the type of contract. The difficulty of the contractors to conduct full survey and time constraints limit the amount of information available to the contractors. The degree of uncertainty is of the highest.

2. Pre-construction stage: The period between the award of contract to mobilisation. Normally, it takes one to three months, depending on the size of the project. The contractors have complete access to the project site. During this stage, a more detail survey could be carried out. The rate at which the amount of information becomes available to the contractors increases rapidly.
3. Construction stage: The stage that takes place during the building process that started one or two months after mobilisation and lasts throughout the rest of the construction life. As the refurbishment projects progress, the amount of information increases and uncertainty decreases.

The respondents in the final postal questionnaire survey were asked to indicate the degree of detail of the planning techniques at pre-bid, pre-construction and during construction stage of refurbishment projects.

The response was recorded on a five-point scale ranging from 1 very low to 5 very high (see appendix L). The result is shown in figure 3.8.

Figure 3.8 The degree of detail of planning techniques at three refurbishment project stages

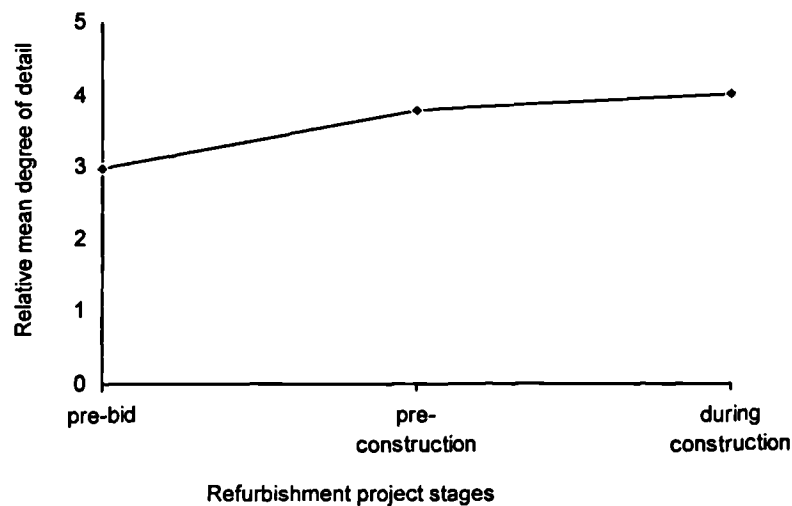




Figure 3.8 reveals that in general, the strategy of the refurbishment project organisations is to increase the level of detail as the project progresses. As more and more information is obtained, more detail is added to the planning techniques. Figure 3.8 confirms the CIRIA's (1994) finding of extremely high level of detail required in refurbishment projects programmes, especially during construction stage.

The strategy to narrow down uncertainty by gathering more information at all stages of refurbishment appears to produce a benefit. The Spearman's correlation technique was used in this study to establish the associations between the degree of detail of planning techniques and the extent to which the planning techniques were used for monitoring during construction. The correlation coefficients are shown in table 3.5.

Table 3.5 Associations between the degree of detail of planning techniques and the extent to which the planning techniques were used for monitoring during construction

Project stages	Correlation coefficients
Pre-bid	.24*
Pre-construction	.33**
Construction	.48**

\* 0.05 significant level    \*\*\* 0.01 significant level

Table 3.5 shows that the greater the degree of detail of planning techniques, the greater the extent to which the planning techniques were used for monitoring during construction. The degree of detail of planning techniques also reflects the capacity of the refurbishment project organisations to increase the information processing capacity. The greater involvement of the planning specialist and the greater use of information technology may increase the extent to which the planning techniques are used for monitoring. These aspects will be covered in a greater detail in chapters 5 and 6.

This result rejects the argument made by Boyd and Weaver (1994) who said that detailed project plans are inappropriate in refurbishment projects because they assume perfect knowledge of the future and are than inflexible when problems arise, forcing people to perform in an inappropriate way. It appears that making assumptions are

inevitable in uncertain refurbishment projects as they provide the basis for monitoring. Certainly, it is better to make the wrong assumptions in order to produce detail plans rather than delaying the decisions until the information is available. Wrong assumptions will enable the refurbishment project organisations to detect where they had gone wrong. This cannot be achieved if the decisions are deferred until late in the projects.

Besides, the problem of flexibility of planning techniques can be overcome by frequent revision of the planning techniques during construction. Laufer and Cohenca (1988) maintained that the frequency of revision of plans indicates the dynamic of the planning process. The participants, who could cope better with the situational variables, would revise their plans more frequently. This view is shared by Young et al (1996) who maintain that frequent revision of project plans during construction stage would help to keep a tighter control over progress of the works.

Young et al (1996) compared the frequency of the planning techniques were revised between construction and ship refurbishment projects. The results are shown in table 3.6.

Table 3.6 The extent to which project plans were reviewed and revised at the construction stage, during refurbishment

Duration	Construction refurbishment (N=11) %	Ship refurbishment (N=25) %
1/2 Daily	0.0	4.0
Daily	0.0	52.0
Weekly	63.6	24.0
Fortnightly	0.0	16.0
Monthly	27.3	4.0
Every 3 months	9.1	0.0
Every six months	0.0	0.0

*Source: Young, B.A, Torrance, V.B and Egbu, C.O. (1996) Managing refurbishment works in the construction and shipping industries, The Bartlett, University College London.*

Table 3.6 shows that the majority of respondents from the construction industry noted that the project plans were reviewed on a weekly basis. Whereas the majority of the respondents from the ship refurbishment reported that the project plans were reviewed on a daily basis. In this context, it could be argued that more effort appears to be put into planning and control by ship refurbishment personnel than by their construction counterparts. Most probably, this is the main reason for the higher extent of use of prepared project plans in decision-making in ship refurbishment, discussed earlier.

In this study, the extent to which the plans were revised in refurbishment projects was measured in a slightly different way. The respondents to the final postal questionnaire survey were asked to indicate how frequently the planning techniques were revised during construction stage of the refurbishment projects. The result is shown in table 3.7.

Table 3.7 The frequency of revisions of planning techniques during construction stage

The frequency of revision of planning techniques during construction	Refurbishment projects (N=67) %
	35.8
1-4 times (infrequent)	49.3
5-8 times (neutral)	14.9
9-12 times (frequent)	

Table 3.7 shows that in the majority of the refurbishment projects, the planning techniques were revised between more than 5 times.

This result implies that to ensure the planning techniques are flexible and were used for monitoring, frequent revision is necessary. Frequent revisions however, require greater human and technical inputs and co-ordination in the planning and control process.

In keeping with the research conducted by Faniran et al (1994) and Ireland (1985), this study measures the quality of workmanship of refurbishment projects. Quality refers to the degree of utility of the constructed product, i.e. the extent to which it can

perform the function for which it was designed. Unlike cost variance and time variance, which can be measured objectively, quality could only be measured subjectively. This study measured the quality of workmanship of the refurbishment projects based on the perceptions of planning and control managers employed in the main construction firms.

There is a valid reason for measuring the quality of workmanship based on the managers' perceptions. Since actions are instituted by the managers, the planning and control activities are affected only after they perceived and interpreted that the quality of workmanship was having an impact on the organisation.

The respondents of the final postal questionnaire survey were asked to indicate the quality of workmanship of the refurbishment projects. The result is shown in table 3.8.

Table 3.8 The quality of workmanship of the refurbishment projects

The quality of workmanship	Refurbishment projects (N=66)%
Low	1.5
Medium	7.6
High	90.9

Table 3.8 shows that in nine out of ten cases, the quality of workmanship of the refurbishment projects is high. Bearing in mind that the population of the present study is planning and control managers employed in construction firms, elements of bias could be not be completely ruled out.

Most probably the respondents relate 'high' quality of workmanship to obtaining certification by the architect and to the payment made for the refurbishment work. During the semi-structured interview, one planning and control manager informed the author that the construction firm would not be paid if the quality of workmanship was low. The architects would insist that any of the defects to be rectified. Because of this,

most refurbishment contractors place great emphasis on the quality of workmanship in refurbishment projects.

The examination of organisational charts obtained in the preliminary postal questionnaire survey reveals that many construction firms have Quality Control/Assurance department (see appendix F). This is further supported by the result obtained in the final postal questionnaire survey which indicates that 78% of the refurbishment projects were carried out by construction firms with quality control and/or assurance department. This is not surprising since the construction firms involved in this study are medium to very large construction firms. The high proportion of construction firms with quality control and/or assurance department indicates that quality control is a major issue in construction projects.

Most of the construction firms interviewed by the author are Quality Assured in accordance with BS/EN/ISO 9002 (formerly BS 5750). Most of the construction firms need to attach the Certificate of Registration issued by the BSI Quality Assurance. The certificate indicates the capability of the construction firms to undertake construction work of specified contract value and procurement systems.

From the archive document obtained from a construction firm, the author discovered that the firm has developed and adopted detailed Quality Assurance Manuals covering all aspects of company organisation, responsibilities, systems and procedures both within its operational offices and on all sites. A review of Quality Assurance issues is incorporated in the firm's formal reporting procedures and is discussed at regular management meetings with actions initiated as required.

The contractor only sent out sub-contract enquiries to tried and trusted subcontractors known to be capable of producing the required quality. Prior to placing orders with subcontractors, pre-order meetings are held at which specification and quality requirements are discussed in detail to ensure subcontractors are fully conversant with

the requirements of the projects. The agenda ensures that requirements for control samples and protection of finished works are discussed and agreed.

During the pre-commencement period the Contract manager/ site manager prepared a Quality Plan for the contract. It defined the method and documenting procedures for dealing with both on- and off-site operations and designate individuals who will be responsible for their implementations and co-ordination. Audits of the Quality Management System are carried out internally by the Quality Assurance manager and externally by the British Standards Institution.

The great emphasis placed by the construction firms on quality control brought into focus the deficiency in cost and time control practised in the construction firms interviewed. There is little evidence that the construction firms provided Cost and Time Assurance certificates or employ an external cost and time control auditor in the refurbishment projects. The responsibility of cost and time control appears to lie in various departments with no single department taking full responsibility.

This probably reflects the greater difficulty in providing cost and time assurance. Egbu (1994) in his study titled 'Management education and training work within the construction industry' surveyed the perception of the training officers in 32 refurbishment organisations on the degree of difficulty of management tasks in refurbishment work. Egbu (1994) found that 62.5% of the training officers perceived quality control and assurance as very difficult/difficult. In contrast, 82.2% of the refurbishment managers viewed forecasting and planning (usually associated with time and cost forecast) to be difficult/very difficult. Since, quality control and assurance is less difficult to be performed, the quality target is more easily achieved.

Unlike the case of cost and time control, the review of literature reveals relatively fewer examples of evidence that the quality of workmanship is a major issue in refurbishment projects. David Pickord (1993: p. 94) Chairman of Haslemere Estates, a specialist refurbishment organisation based in London, however noted about one of his projects, 'We brought out of retirement of a number of octogenarians because they

were the only men capable of executing fine plasterwork and wood carving'. It should be highlighted that the refurbishment work mentioned by Pickford (1966) is a refurbishment of a listed building of high historical value and the quality plasterwork and woodcarving are major issues.

Evamy (1988: p. 24) highlighted the difficulty of matching new construction with old. It demands high levels of craft skills and attention and said, 'it is no secret that the business of blending new construction with old holds a unique stock of technical booby-traps'.

The statements made by Pickford (1966) and Evamy (1988) provide valid reasons to believe that the quality of workmanship in refurbishment work depends on the quality of supervision and the availability of materials and labour when the projects were executed. The shortage of skills, supervisors, materials and tradesmen would be more acute during a boom period.

It must be pointed out here that the refurbishment projects analysed in this study were undertaken between 1991-1994 when the construction industry was facing recession (see figure 3.1). The majority of the refurbishment projects faced no shortage of material and labour. This will be discussed in chapter 4. The high percentage of the refurbishment projects with high quality of workmanship could be attributed to this.

The planning performance of refurbishment projects is the central issue of this thesis. The extensive literature review conducted in this study revealed that planning performance of refurbishment projects could be affected by many factors, as shown in figure 3.9. Figure 3.9 provides the theoretical framework of this study. The relationships between each set of variables will be explained in detail in the following chapters. A brief description on the theoretical framework is presented here to help the reader to follow the rest of this thesis.

There are many factors that contribute to the complexity and uncertainty of refurbishment projects. The review of literature reveals that the project complexity

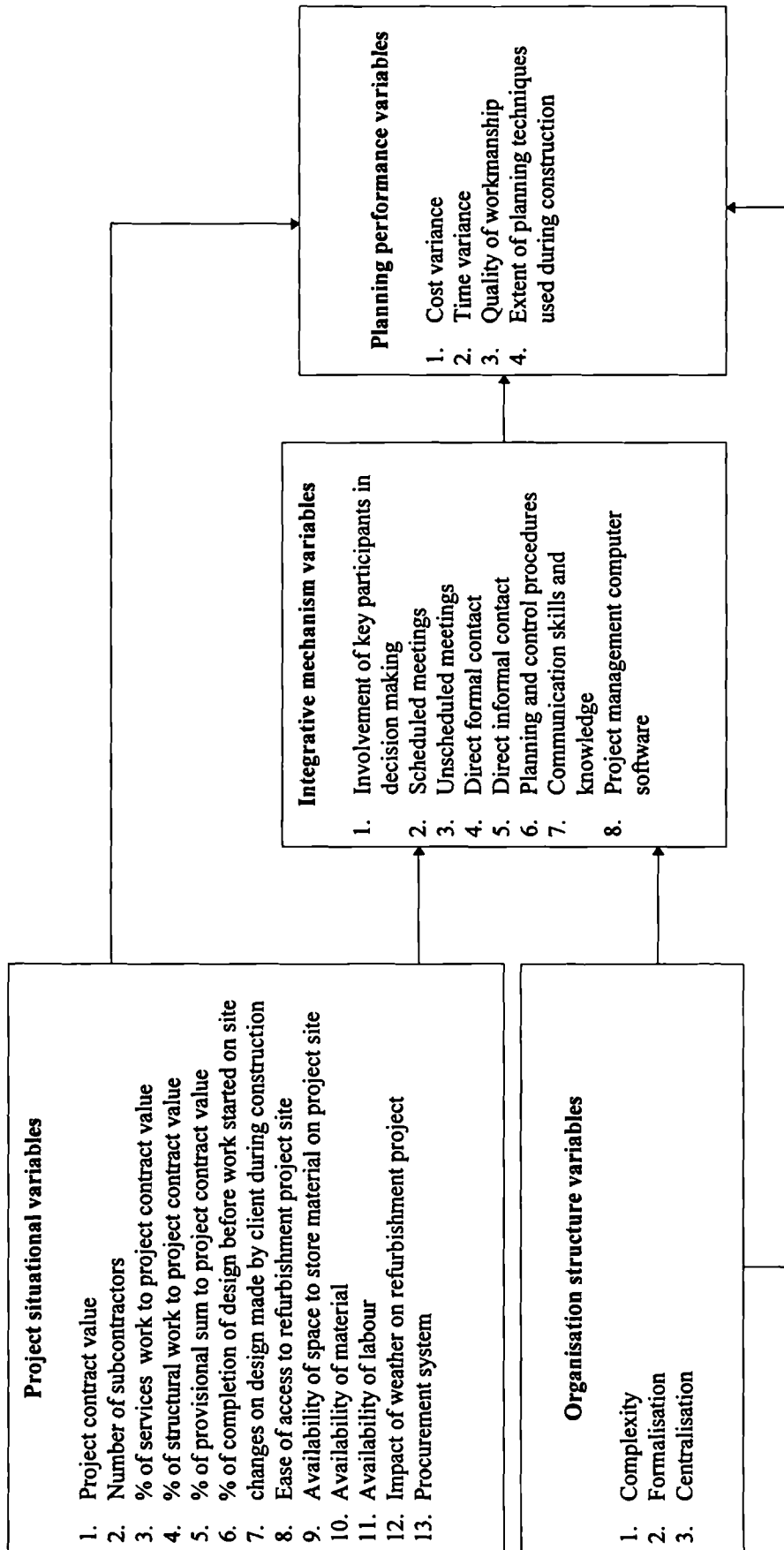
and uncertainty variables shown in figure 3.9 are the most important factors that contribute to the planning performance of refurbishment projects. This will be discussed in greater depth in chapter 4.

The ability of refurbishment project organisations to improve information processing capacity depends on the integrative mechanisms used in the refurbishment projects. In order to increase performance, increase use of integrative mechanisms may be necessary. In the context of this study, the integrative mechanisms are classified into two a) involvement of key participants in decision-making and b) co-ordination devices. These will be discussed in chapter 5 and 6 respectively.

However, the integrative mechanisms employed in the planning and control process are influenced by the organisation structure of construction firms undertaking the refurbishment projects. Most construction firms face conflicts whether to satisfy the long-term and more permanent objectives of the construction firms, reflected in their organisation structure, or the short-term more temporary objectives of a construction project (Bresnan, 1988). This will be discussed in chapter 7.



Figure 3.9 Theoretical framework



### 3.3 Conclusions and recommendations

The importance of the refurbishment sector, which constitutes more than 40% of construction output of the construction industry has been discussed. The major factors that contribute to the growth and importance of refurbishment work in the United Kingdom are as follows :-

- Large stock of redundant and ageing buildings.
- Financial pressures.
- Technological change.
- Environmental awareness.
- Social factors.
- Planning constraints.
- Compliance with shops, offices and factory legislation and other statutory instruments.

The levels of planning performance of refurbishment projects were examined. It was found that 53.3% of refurbishment projects exceeded the target cost and 52.5% exceeded the target time.

It has been suggested that the cost variance of refurbishment projects could be reduced by greater emphasis placed on cost control. Efficient flow of cost information and high information processing capacity in the planning and control process are considered to be vital. These require active involvement of cost controllers or estimators in decision-making throughout the refurbishment project duration. Various integrative mechanisms have been suggested to increase the information processing capacity.

The use of systematic planning and control procedures and detailed plans to detect deviations have been suggested to reduce time variance.

The planning techniques are important tools in the planning and control process of refurbishment projects. They are extensively used in nearly 80% of refurbishment projects. They are characterised by high level of detail.

The complexity and uncertainty of refurbishment projects however require that the key participants involved in the preparation of planning techniques to base their decisions on many assumptions. This requires the planning techniques to be flexible.

The flexibility of planning techniques is achieved in two ways. Firstly, the planning techniques must be simple and understood by the key participants. This is reflected in the popularity of bar chart in refurbishment projects. Secondly, the planning techniques require frequent revision during construction stage.

In general, the quality of workmanship of refurbishment projects was found to be high. This is attributed to the high emphasis placed by most construction firms on quality control. The majority of the construction firms have quality control and/or assurance department. Most of the construction firms provide quality assurance to their clients and are registered with the BSI Quality Assurance. Listed buildings however require special attention as they are mostly to suffer from shortage of skilled craftsmen and materials.

Statistical analyses will be conducted in the following chapters to determine the major factors that influence planning performance of refurbishment projects.

## **Chapter 4**

### **Complexity and uncertainty of refurbishment projects**

#### **4.0 Introduction**

It has been established in chapter 3 that more than half of the refurbishment projects exceed target construction time and target construction cost. The inherent complexity and uncertainty of refurbishment projects are among the factors attributed by many management writers to the difficulty in keeping the cost and time on target. Most of the refurbishment writers however provided only anecdotal evidence to support their theses. Few have addressed the issues of complexity and uncertainty systematically and explicitly. None, to the author's knowledge, have applied rigorous statistical analysis to substantiate their arguments. These shortcomings need to be mitigated.

The main objectives of this chapter are:-

1. To establish the variables that contribute to the complexity and uncertainty of refurbishment projects.
2. To establish the relationships between the complexity and uncertainty variables and planning performance.

#### **4.1 The measurement of complexity and uncertainty of refurbishment projects**

Complexity and uncertainty are two terms that many management writers tend to use interchangeably even though they are defined differently. Complexity is defined as the number of different actions needed to produce the end product (Bennett, 1992) whereas uncertainty is defined as the difference between the amount of information

available to perform a task and the amount of information possessed by the planner (Galbraith, 1977).

Winch (1989), however, argued that there is almost certainly a strong correlation between task complexity and task uncertainty in construction projects. Thus, bounded rationality (the tendency of managers to select a convenient and low-risk outcome to a problem rather than attempt a theoretically superior solution generated by project uncertainties) will be compounded by project complexities.

Complexity and uncertainty are inherent in all construction, no matter what the size of the project (Thompson and Perry, 1992; Smith, 1989 and Gorgone, 1992). They are characterised by intense interactions between groups of participants, which tends to lead to inter-group and interpersonal conflicts. To reduce conflicts and to achieve coherent objectives, construction projects require integration of many disciplines across organisational boundaries.

Young et al (1996) maintained that managing a refurbishment project is managing a dynamic environment, a condition in which the situation is ever changing such that the present data may turn out to be a poor guide to future states. Refurbishment planning involving many interdependent decisions on interrelated aspects of the works, and for decisions to be fully and effectively accommodated, refurbishment planning would need to address complexity and uncertainty more explicitly and systematically.

The review of literature reveals that many management writers, outside construction, have proposed methods of measuring the complexity and uncertainty faced by an organisation. Duncan (1972), Lawrence and Lorsch (1967) measured complexity and uncertainty subjectively, based on people's perceptions. Michael (1973) and Weick (1969) argued that subjective measurement is valid. Since actions are instituted by individuals, management activities are affected only after someone has perceived environmental conditions and interpreted them as having an impact on the

organisation. Thus, complexity and uncertainty may be meaningless for organisational action until the decision-makers classify it as important. The determining factor in a manager's action is his perception of complexity and uncertainty.

Van de Van and Delbecq (1974) in their study titled, 'A task contingent model of unit work structure', measured the effects of uncertainty on the extent to which departments in an organisation used various integrative mechanisms. In the study, the degree of uncertainty was measured subjectively, by asking the respondents whether the task uncertainty faced by their organisations was simple, medium or complex. Van de Van and Delbecq (1974) found that in general, increased uncertainty faced by an organisation led to an increase in the extent to which the integrative mechanisms were used. This method was replicated by Naoum (1990) in his study titled, 'Critical analysis of time and cost of management and traditional contract'. From the analysis of 30 traditional contracts and 39 management contracts, Naoum (1990) found that management contracting performed better than traditional contracting for bespoke large building projects with a high level of complexity and uncertainty.

The measurement of complexity used by Naoum (1990) is too broad, and is very unlikely to offer significant contributions towards solving the planning and control of refurbishment projects. In order to help managers to plan and control, the managers need to know the variables that contribute to the complexity and uncertainty of refurbishment projects. Different situational variables may need different solutions.

Santana (1990) proposed that project complexity be measured by aggregating a number of variables such as cost and financing, physical location, impact on natural and social environment, technology, resources and logistics of construction, difficulty of access, large number of specialised workers and the number of contractors and subcontractors. The degree of complexity for each complexity variable was measured using a ten-point scale, ranging from 1 (normal) to 10 (singular). The aggregate score was then obtained. From the aggregate score, the construction projects could then be classified into singular, normal and complex. The complexity variables and the form

used to classify the construction projects proposed by Santana (1990) are shown in appendix N.

One criticism of Santana's (1990) method is that all complexity variables are given equal weight. It assumes, for instance, that the number of subcontractors employed in construction projects to be as important a variable as the impact of the environment.

The broad measurements of project complexity and uncertainty used by the construction management writers cited above are unsatisfactory. It is always possible, but rather unsubstantial, to claim that refurbishment projects are complex and uncertain simply by resorting to broad measurements. If, for example, claims were to be made that the high content of services work in refurbishment was the main factor that caused complexity and uncertainty, researchers should be at least able to specify the content of services work in a typical refurbishment project.

Faniran et al (1994) in their studies titled 'The effectiveness of construction planning' measured the complexity of construction project subjectively and objectively. Among the situational variables measured objectively were; the number of subcontractors and the number of construction trades employed in the construction projects.

The variables measured subjectively by them were the percentage of completion of design before the onset of construction, past construction experience, weather predictability and the availability of labour and material in the vicinity of the construction project.

It should be pointed out here that some of the 'complexity' variables measured by Santana (1990) such as the availability of labour and the impact of environment were measured as situational variables by Faniran et al (1994). But, as has been argued by Winch (1989), project complexity and project uncertainty are strongly correlated. Measuring one would invariably be measuring the other. Therefore the approach used

in this study is to combine the ‘complexity’ and ‘uncertainty’ variables to form a single entity. For the sake of convenience, the complexity and uncertainty are referred to as **situational variables** throughout this thesis.

In this study, there will be no attempt to classify the refurbishment projects into ‘simple’ and ‘complex’ by aggregating the score of all variables as proposed by Santana (1990) since the size of the refurbishment projects would reflect the aggregate complexity and uncertainty of the refurbishment projects. Each situational variable will be treated independently. The reason for this is to enable the author to detect the links between each situational variable with the planning performance variables.

## 4.2 The situational variables

The review of literature reveals 13 situational variables, as shown in figure 3.9, which are dominant in refurbishment projects. The exact wording and measurements of the situational variables are shown in appendix L. The situational variables are discussed in turn below.

### 4.2.1 The size of refurbishment projects

The size of construction projects is normally measured in terms of contract value. As the size increases, the complexity and uncertainty tend to increase. Larger construction projects are characterised by insufficient information to plan in detail at the start of the projects and endemic changes throughout the projects’ life. The effectiveness and efficiency of information flow and the ability to control the outcomes of such projects are reduced (Harrison, 1992).



Refurbishment, however, tends to be associated with smaller projects. Quah (1992) in her study 'Competitive tendering for refurbishment work', produced the frequency distribution of the size of refurbishment projects, as shown in table 4.1, that she obtained from the London Conference, a contractors' advisory organisation which collects data on construction projects undertaken by their members.

Table 4.1 The frequency distribution of the size of refurbishment projects

Size of project (in million pounds)	Refurbishment projects (N=1350) %
Less than 0.1	5.3
0.1 - 0.5	54.4
0.5 - 1.0	22.8
£1.0 - £1.5	8.8
£1.5 - £2.0	4.4
£2.0 - £2.5	2.6
£2.5 - £3.0	0.8
More than £3.0	1.9

*Source: Quah, L.K (1992) Competitive tendering for refurbishment work, Building Research Information, Vol 20, No 2.*

Table 4.1 reveals that nearly 60% of the refurbishment projects are of less than £0.5 m. only 18.5% were above £1m. Smaller construction projects tend to be associated with smaller construction firms with lower management expertise. Probably, the association of refurbishment with smaller projects led to Egbu's (1994) observation that refurbishment projects tend to be treated as 'poor cousins' and often used for training inexperienced managers.

It should be pointed out that large refurbishment projects of contract value over £10m are not uncommon. The refurbishment work on Natwest Tower in the City of London,

which is due to be completed in 1997, for instance, covers 29530 m<sup>2</sup> floor area and of contract value of more than £70 m.

Quah (1992) observed that in new build works, contractors tend to concentrate in tendering within a defined range, i.e. large contractors do not normally compete in small-sized projects. However, many large contractors have entered into the smaller refurbishment sector which according to Quah (1992: p. 1) 'should bring better management expertise into this traditionally less organised sector of building work'.

The preliminary postal questionnaire survey conducted in this study reveals only 48% of large construction firms (annual turnover greater than £11 million pound) undertake refurbishment work of £1,000,000 or less. Most of these large construction firms tend to take larger refurbishment projects. Hence, the benefits that could be accrued from the entry of large construction firms is more likely to be limited to larger refurbishment projects. This aspect will be further discussed in chapter 7.

In order to exclude the repair and maintenance work from this study, only refurbishment projects of contract value over £0.5m were surveyed. The refurbishment projects were obtained in the final postal questionnaire survey. The result is shown in table 4.2.

Table 4.2 The size of refurbishment projects

Size of project (in million pounds)	Refurbishment projects (N=67) %
0.5- 1.0	22
1.1 - 1.5	24
£1.6 -2.0	15
£2.1 -2.5	6
£2.6 -3.0	3
More than £3000000	30

Table 4.2 shows that the frequency distribution of the refurbishment project size is more evenly spread in this study than Quah's (1992) study. However, a high proportion (46%) of the refurbishment projects were valued between £0.5m and £1.5m which is similar to Quah's (1992). Thirty percent of the refurbishment projects were of contract value over £3.0m. Considering that the construction firms that participated in this study were medium and large construction firms, it is not surprising that the projects selected by them tend to be larger in size.

The presence of large refurbishment projects implies the need to employ planning and control managers who have high management skills and capable of using sophisticated management tools such as computers. This is to ensure rapid decision-making and flow of information. Computer technology could be utilised to ensure that the cost and time of refurbishment projects could be monitored more effectively. The presence of large refurbishment projects also strengthens the argument that refurbishment is important in its own right, and should not be treated as a poor cousin. It supports the argument for the need of specialised training in refurbishment.

This study found, as shown in table 4.3, that office refurbishment comprises 42% of the total of refurbishment projects. The increase in the rate of change in information

technology and the need to maintain image and status require offices to be refurbished more frequently.

Table 4.3 The types of building in refurbishment projects

Types of project.	Refurbishment projects (N=67) %
Office	42
Residential	28
Shop	6
Hospital	6
School	4
Industrial	1
Others	12

At the outset of this study, it was hypothesised that the types of building determine the complexity and uncertainty of the refurbishment projects, mainly due to the significant differences in the content of services work. It was believed that hospital refurbishment projects would have higher content of services work.

The Kruskal-Wallis technique employed in the present study revealed that there was no significant difference in the content of services work in the different types of refurbishment projects.

During the semi-structured interview, the majority of the planning and controlling managers interviewed maintained that the complexity and uncertainty of refurbishment projects were influenced by many factors. Each type of building and each type of project has its own unique problems. A planning and controlling manager quoted that due to its clinical requirement, occupied hospital refurbishment projects require special attention to dust and noise control problems. Another planning and

controlling manager, however, said that shop refurbishment projects tended to be more complex because the majority of them had to be refurbished when the shops were opened for business. In addition, shops and offices refurbishment projects had to face greater problems of interference from the public. This necessitates extra provisions to protect the welfare of the occupants and public. To compound the problems, office and shop refurbishment projects tend to have less space and greater difficulty of access than the other types of refurbishment projects.

The majority of the planning and control managers interviewed agreed that it was difficult, and certainly not useful to generalise which types of refurbishment projects were more uncertain and complex.

Thus it could be concluded, that the type of building provides only a few indications to the degree of complexity and uncertainty of refurbishment project. It is most likely that each type of refurbishment project has its own unique problems that require different solutions.

The Kruskal-Wallis technique however revealed access to office refurbishment projects is significantly more difficult than to hospital and housing. The same test also revealed that the space for storage material is significantly smaller in office refurbishment projects. Since most offices tend to be located in confined commercial areas with difficulty of access to project sites, they are more likely to be subjected to public interference which could impinge on the planning performance. Issues relating to public welfare also tend to be dominant. In such refurbishment projects, there would be a greater need for refurbishment contractors to implement Latham's (1994) proposal to improve their public image. This demands effective communication skills from planning and control managers to deal with the public and the occupants of the refurbished and neighbouring buildings.

Many refurbishment contractors in London participate in The Corporation of London's 'Considerate Contractors Scheme'. This scheme encourages the

refurbishment contractors to abide by the Code of Practice to ensure public safety and welfare. In these refurbishment projects, well placed posters which notify the public about the Code of Practice may provide constant reminders to the people involved in the refurbishment projects about their public obligations. Most certainly this would help to increase public acceptance of refurbishment projects.

#### 4.2.2 The state of completeness of design before refurbishment projects commenced on site

Generally, a project that is ill defined and is outside the range of experience will be relatively uncertain in its performance. The productivity of any one team in the project tends to vary from day-to-day. Bennett (1992) maintained that a project that demands new answers leads to uncertain work and requires additional management. Winch (1989) quoted rehabilitation work as the most prone to task complexity and uncertainty.

Pin (1991) maintained that it is the nature of refurbishment with the unknown condition of the existing building that brings about the poor documentation of information. Boyd and Weaver (1994) observed that because project uncertainty leads to greater reliance on provisional sums, there is greater tendency for refurbishment projects to exceed the target cost. The contractors also tend to rely more on 'gut feeling', or intuition than on systematic procedures when bidding for refurbishment projects. Risk allowances were incorporated in the tender by means of lump sum additions to the net cost, or by high mark-up (Quah, 1992). It is likely that it is more difficult to train and to transfer knowledge by taught methods to the new planning and control managers in refurbishment projects as the knowledge is dispersed among experienced refurbishment managers, each with his own unique experience. This implies that the managers employed in refurbishment projects need to possess practical experience.

Young et al (1996) compared the state of completion of design before refurbishment work commences in the construction and shipping refurbishment sectors. It was found that in 66.6% of those from construction refurbishment that 50% of designs were complete, in contrast to 80% from ship refurbishment (see table 4.4). This indicates construction refurbishment starts work with a higher degree of uncertainty and therefore requires more information processing capacity during the construction stage than shipping refurbishment.

Table 4.4 The state of completion of design before refurbishment work commences (comparison of shipping and construction)

The state of completion	Construction (N=12) %	Ship refurbishment (N=25) %
76% -100%	6.3	32.0
51% - 75%	58.3	48.0
25% - 50%	25.0	20.0
Less than 25%	8.3	0.0

In the final postal questionnaire, the respondents were asked the state of completion of design before commencement of refurbishment work. As table 4.5 shows, 50% of refurbishment projects commenced work on site with only 60% of design being complete. Less than a fifth of the refurbishment project started the work with more than 80% of the design being complete.

Table 4.5 The state of completion of design before refurbishment work commences

The state of completion	Refurbishment projects (N = 64) %
More than 80%	20.3
61% - 80%	29.7
41% - 60%	16.8
21% - 40%	24.4
Less than 40%	7.8

This result has three major implications. Firstly, there is a high degree of reciprocal interdependency between the clients and contractors during the construction stage. Reciprocal interdependency is characterised by the task to provide information that moves backwards and forwards between a number of teams, in this case, between clients and contractors. The less complete the design before work commences, the closer the contact and good communications are required between the interdependent teams. This implies that a high degree involvement between client and designers is needed during construction.

Secondly, refurbishment work necessitates a shorter communication time between sources of information held by the of decision-makers and the implementers. One option is to delegate more decision authority to lower echelons, for instance to site managers. Decentralised construction firms may be more appropriate in refurbishment projects. Egbu (1994) however found that instead of decentralising, many senior managers involved themselves in the day to day running of refurbishment projects. This arguably is not an efficient way of managing resources. The shortage of trained and experienced site managers or the need to speed up decisions could be the reasons for the senior managers to be actively involved in daily operations of refurbishment work.

Thirdly, more detailed and quality information gathering is necessary at the early stage of refurbishment projects. A thorough structural survey is required. The involvement of experienced construction firms during the building survey could improve the quality of information obtained at design stage which implies that an appropriate procurement system, such as design and build should be considered for refurbishment projects.

The CIOB (1987) pointed out that the inadequacy of information makes it difficult for the contractors to produce the method statements and programmes in refurbishment projects. The allocation of resources could only be made approximately, thus the level



of labour productivity could not be controlled effectively. This could lead to difficulty in achieving planning performance targets.

#### 4.2.3 Changes in design made by the client during construction

Okoroh (1992) noted that the inadequacy of specifications and design information and changes made by the architects as the work progresses, make it difficult for contractors to define the exact scope of work in advance. There would therefore, be a greater tendency for cost and time to vary from the original targets.

The difficulty to plan and control also tends to lead to the disruption of the programme. The BRE (1990) maintained that the prolongation and disruption costs were often of the same magnitude as the costs of the additional works. Even though the BRE (1990) found that none of the refurbishment projects under study required litigation, the settlement of the final accounts often incurred unaccounted costs for consultants and contractors. This has led to negative feelings among the clients who undertake refurbishment projects.

Table 4.6 shows the degree of changes made in design during the construction stage of refurbishment projects surveyed in this study. Table 4.6 shows that endemic changes in design were made during the construction stage, with 51.5% to a large/very large extent. Considering that about half the refurbishment project started the construction work with only 60% of design being completed, this result did not come as a surprise. The Spearman's correlation technique shows that the state of completeness of design before the work commenced on site and the changes made by the client during the construction stage are correlated (correlation coefficient of 0.38 at 0.01 significant level).

**Table 4.6 The degree of changes in design made by the client during construction**

<b>Degree of changes</b>	<b>Refurbishment projects. (N=66) %</b>
Very small extent	4.5
Small extent	13.6
Neutral	30.3
Large extent	27.3
Very large extent	24.2

Young et al (1996) observed that design changes and other changes made during the course of refurbishment work are documented, and passed on to the client after the refurbishment. Funds are specifically made available for this purpose, as part of the contract with the main-contractor. This practice should allow as-built drawings to be available for future refurbishment works.

The main concern here, however, is that the changes made by the client tend to incur additional cost to the refurbishment projects. It would certainly be desirable if the clients were adequately briefed during the design stage by their designers. This may necessitate greater effort by the designers to provide more complete designs before the work commenced on site. This implies that a greater effort is necessary in data gathering before work commences.

The effects of changes made in design during the construction stage are demonstrated in the refurbishment work on the Department of Energy building, Buckingham Gate, London completed in 1989 valued at £50,000,000. The building, which earned a conservation award from the Westminster Society, was undertaken by Lovell Construction. Seven months after the construction work had started, fitting out work was added to the original contract. This made design control crucially important. The contractors had to continually appraise the impact of the additional work, making

arrangements for existing construction work to proceed wherever practicable. The original programme had to be revised which needs extra resources for co-ordination.

Changes in design during construction has two major implications. Firstly, it is susceptible to opportunistic behaviour. Invariably, the contractors would claim for higher variation orders. This may cause increase project cost, delays and reduced client satisfaction. It may also lead to conflicts in the project, especially between the client and the main contractor.

Secondly, the involvement of contractors during the design stage may help to narrow down complexity and uncertainty during execution of the refurbishment projects by providing the necessary design information before the projects commenced on site. In the case of the Buckingham Gate refurbishment project, the design and build procurement system was used which helped to provide integration between the design and construction processes. Thus the effects of changes in design to the overall project cost were reduced.

#### 4.2.4 The percentage of provisional sum to project contract value

Quah (1986) noted that most refurbishment projects were set out for tendering on the basis of very little structural survey of the existing buildings. Detailed survey is not always feasible because the buildings tend to be occupied (Boyd and Jankovich 1993). This necessitates a greater proportion of provisional sums and contingency allowances in the tender documents than that of new build work. This, according to Quah (1986) was necessary because of the unknowns, which may be uncovered during the execution of the work. There is also a higher proportion of variation orders in a refurbishment contract, and the tendency for the job to expand to meet the budget.

Boyd and Weaver (1994) confirmed this observation. In their analysis of 8 refurbishment projects, they discovered that 5 (63%) of the projects required extended

contract periods due to additional works. These additional works comprised largely of additional repairs and replacements to fabric, finishes or services to the buildings. The BRE (1990) maintained that normally, the problems that derive from additional works are often underestimated. The final account costs of refurbishment projects frequently rise unacceptably beyond original estimates.

Table 4.7 shows that in 32.9% of the refurbishment projects surveyed in this study, the percentage of provisional sum is more than 10% of the project contract value.

Table 4.7 The percentage of provisional sum to project contract value

% of provisional sum	Refurbishment projects (N=62) %
Less than 5%	33.3
6% - 10%	34.9
11% -15%	22.2
16% - 20%	6.3
More than 20%	4.2

The tendency for refurbishment projects to create additional work as the projects progressed, have far reaching implications. Firstly, the use of a procurement system which provides greater integration between design and construction process, such as design and build may be more appropriate. The Kendall's tau-b technique was used to establish the difference in the percentage of provisional sum in traditional and design and build procurement systems. This study found that the percentage of provisional sum in refurbishment projects using design and build was significantly lower than using traditional procurement system (correlation coefficient 0.36 at 0.01 significant level). Secondly, it necessitates increased involvement of estimators in decision-making during the construction stage because the costs of the works need to be

adjusted and controlled more frequently. Thirdly, the site managers selected must possess the vital cost information to be able to plan and control the refurbishment projects effectively.

#### 4.2.5 Percentage of structural work to project contract value.

Bennett (1992) argued that technology is a major factor that contributes to complexity and uncertainty. Technologies are distinct bodies of knowledge and sets of skills needed to be applied in order to use related tools, plant and equipment. Winch (1989) identified the installation of services among the most difficult work in construction projects that require special technology. Other works that require special technology are engineering and structural work (Reve and Levitt, 1984).

To obtain sufficient information, comprehensive structural surveys, especially for old buildings are normally necessary. This tends to increase the project cost. Comprehensive surveys may be difficult in occupied buildings. Besides, in older buildings, the extent of the problems are not normally discovered until demounting and stripping works have commenced. Hence, complete and accurate survey is not always feasible. In many refurbishment projects, information relating to structural works is based only on small sample (CIOB, 1987). The inadequate or incomplete information poses difficulties to plan and control and imposes contractual risks on the contractors.

Fiedler (1987) maintained that building structures requiring reconstruction were originally erected on the basis of individual projects. Even structures dating from the same period are not standardised. The activity of the structural work needs to be broken down into smaller sub-activities based on technological and construction similarities and the same degree of wear and tear. In refurbishment projects, the structural work needs to be progressed by concentrating on structural works of similar conditions, requiring similar technology at a time.

The refurbishment work on Apollo House, in Croydon is a classic example of these problems. The office block is 22 stories high and has a total floor area of 18,395 m<sup>2</sup>. The existing building has a reinforced concrete frame with differing cladding to each block. Precast concrete panels on the Main Block are being extensively repaired or replaced. The Core Block brickwork and concrete supporting nibs are being repaired and windows/curtain walling are being replaced. The structural work had to be broken into sub-activities.

The breaking up of structural work into sub-activities, depending on the technology needed, would lead to greater complexity in the refurbishment work. The continuity of the refurbishment projects is hampered. Greater integration between key participants involved in the project is required. More detail planning techniques are required.

Okoroh (1992) maintained that technical skills in demolition, shoring and excavation are important to ensure accurate predictions. The accuracy of estimating, therefore, depends more on the experience and insights of the estimators rather than on standardised procedures. To produce estimates based on the Standard Method of Measurement (SMM) is therefore difficult.

Refurbishment projects that involve extensive structural work tend to use heavy plant, such as tower cranes, which lead to increase difficulty of access to project sites and reduces the amount of space available to work and store materials. The Spearman's correlation technique reveals significant correlation between the percentage of structural work relative to total project contract value and difficulty of access to project site (correlation coefficient of 0.31 at 0.01 significant level) and to the amount of space available for storage of material (correlation coefficient of 0.29 at 0.01 significant level).

The refurbishment of Transad House, at Leicester square, for London Underground Ltd for instance, required the use of mobile crane, operating in the early hours of the working day to deliver any new structural steel or timbers to the building.

The refurbishment of JLP Investment Company Ltd, at no 1, Camomile Street, City of London as a result of bomb damage, used a tower crane mounted on the 2nd floor podium roof. The work required external works to the structure and included removal of the existing stonework cladding and windows followed by total replacement of the original design.

Structural work tends to impinge on other trades, especially services. The sequence of structural repairs and alterations have to be planned to suit the overall programme requirements. It will determine the volume of works that may be undertaken on each floor and areas above and below. Thus structural work tends to become a critical activity on most refurbishment projects and requires greater attention.

The result obtained from the final postal questionnaire survey of this study, however, reveals that percentage of structural work to contract value in the majority of refurbishment projects is less than 15%. As table 4.8 reveals, 40.3% of them were found to be less than 10%. This also suggests that a typical refurbishment project is geared more towards craft work, characterised by works that use small hand tools, rather than heavy structural or engineering work that is characterised by the use of heavy plant.

**Table 4.8 Percentage of structural work relative to project contract value**

<b>% of structural work</b>	<b>Refurbishment projects. (N=62) %</b>
Less than 10%	40.3
11% - 15%	21.0
16% -20%	17.7
21% - 30%	4.8
More than 30%	16.1

Because the percentage of structural work is small relative to contract value in most refurbishment projects, the opportunity to gain extensive skills and knowledge on structural work is limited. Also, because of the small proportion of structural work in most refurbishment projects, there would be a greater tendency for the contractors to sub-contract the work to specialist sub-contractors. An increase in the number of specialists would need an increase in co-ordination and increase in the use of resources.

It also implies that knowledge relating to structural work is not easily transferable, and tends to be concentrated among a few specialists. The client needs to select experienced specialists structural contractors for refurbishment projects involving a high content of structural work.

#### **4.2.6 The percentage of services work to project contract value**

Stone (1976) pointed out that the increase in services provided in a building has added to erection problems as well as to design problems. It may require more detailed drawings. Often specialised knowledge in services installation becomes more critical.



The role of the traditional crafts tends to be reduced and more specialist workers need to be employed.

Stone (1976) further added that one of the most fruitful ways of reducing costs in services work is to eliminate operations, for example, by incorporating the services into the wall and floor units, or by producing units which are self-finished. In a refurbishment work, to incorporate the services into the existing structures, in most instances, would require extensive cutting and carving works. Services work tends to be sequentially interdependent of structural work. It could only commence after sufficient areas are structurally complete. The continuity of services around the block is more likely to be difficult to achieve.

To compound the problem, the British system of bills of quantities for services works are rarely listed in detail. Usually the engineering and services works are specified in general terms and only provisional sums are inserted (Boyd and Weaver, 1994).

The physical separation of the teams involved in the project work merely reinforces differences in the knowledge, skills, tools, plant and equipment, specific to their technology being used. A typical example is when the services trades may have to work at night, thus being separated from other trades. There would be instances when the services trades need information relating to the strength of the building structures from the structural trades before services could be installed. This separation, in turn, could cause stress-related problems, especially when separation and restrictions lead to disruptions and inefficiency in communication. Constant dislocations may cause disagreements among participants.

Fiedler (1985) maintained that to minimise disruptions of building use, the work activities need to be sequenced to follow the characteristics of fast assembly lines. To achieve this in refurbishment work is often difficult, if not impossible, as the work needs to be in a section of the building at a time. Fielder (1985) observed that various trades need to work simultaneously at each section of the building and then proceed

together to the next section. Continuous sequencing of each trade is required. This is difficult to be programmed if each trade requires different times and different duration and yet each is interdependent upon the others. It is even more difficult if the trades come from different organisations. Fiedler (1985) therefore cautioned that that continuity of activities in refurbishment projects could only be achieved approximately.

Thus discontinuous processes need to be tolerated in refurbishment projects. This invariably caused a non-uniform resource allocation, and the activities tend to be fragmented giving rise to difficulty in planning and controlling. Fiedler (1985) therefore suggested that because of the higher complexity and uncertainty of refurbishment projects, special management of time and resource reserves and computer-aided control may be required.

From the final postal questionnaire survey, it was found that most refurbishment projects have high services content. As table 4.9 reveals, 78.2% refurbishment project surveyed, involved services work of more than 20% of project contract value. The mode is more than 35%.

Table 4.9 The percentage of services work to project contract value

The percentage of services work to project contract value	Refurbishment projects (N=64) %
Less than 20%	21.9
21% - 25%	17.3
26% - 30%	20.3
31% - 35%	14.1
More than 35%	26.6

The high percentage of services work to contract value in many refurbishment projects implies that refurbishment projects involve a higher technological requirements,

which necessitates the employment of a higher number of specialist labourers. The issues of fragmentation of organisation and the continuity of work would need special attention and a high input in site co-ordination.

It also implies the need to employ site managers who have specialised knowledge in services work. Refurbishment construction firms may need to create a special department to provide training in managing services work.

The creation of special 'task force' in services, especially in large refurbishment projects, may also be necessary. It also demands that the planning and control managers have skills and knowledge in computer technology to improve co-ordination in project organisation.

The refurbishment of the Scottish Amicable Life Assurance Society Office Building at Gray's Inn Road, EC1 demonstrated how services work could be planned and controlled. The contractor had to assign a site manager with services expertise to provide co-ordination of the installations. A major function was to ensure integration of the services with other elements of the structure and finishes to avoid clashes. This was especially important with the suspended ceiling contractor.

Lovell Construction, the main contractor in the refurbishment project, emphasised the importance of the site management to be experienced in services installation in refurbishment work. The integration of the services programme with other trades was absolutely vital for the contract to proceed smoothly. Particular attention had to be paid by services engineers and planners in determining the sequence and timing of the testing and commissioning of the services installation. This involved the monitoring and control of subcontractors' progress with regard to information requirements, submission and approval of drawings, and all on and off-site works. In most instances, site management who specialised in services work were assigned to their refurbishment projects. In fact, in many refurbishment projects undertaken by Lovell Construction Company, regular 'Services Co-ordination Meetings' are conducted.

#### 4.2.7 The number of subcontractors employed in the refurbishment projects

The complexity and uncertainty of refurbishment projects could be derived from the degree of interdependency between the contributors within a construction project team. Winch (1989) called it organisational complexity and uncertainty. The large number of subcontractors employed in refurbishment projects reflect the organisational uncertainty.

Table 4.10 shows that 66.4 % of refurbishment projects obtained in this study employed more than 15 subcontractors. Laufer (1991) in his study titled 'Construction planning in uncertain environment', classified construction projects with more than 15 subcontractors as complex.

Table 4.10 The number of subcontractors employed in refurbishment projects

Number of subcontractors	Refurbishment projects (N=65) %
Less than 10	7.7
11 - 15	26.2
16 - 20	24.6
21 - 25	13.8
More than 25	27.7

The large number of subcontractors employed in refurbishment projects implied that a large number of different trades specialising in different technologies are needed in refurbishment projects. Considering that the majority of refurbishment projects employ more than 15 subcontractors, it could be concluded that the organisation of refurbishment projects tends to be fragmented.

Winch (1989) pointed out that organisational complexity and uncertainty in a construction project is further exacerbated by the temporary organisation. In a large

project organisation, tensions among project members tend to occur. (Wilemon and Gemmil, 1971).

The high proportion of refurbishment projects employing a large number of subcontractors has four major implications. Firstly, there is a need to improve interpersonal skills of communication of refurbishment managers. This will enable them to co-ordinate the subcontractors more effectively. Secondly, there is a need for closer monitoring, supervision and co-ordination. The project programme needs to be produced in detail, in order to show the inter-relationship of subcontractors' activities. This may require high involvement of planner in decision-making during construction stage. The use of project management computer software may also be necessary for this purpose. It also requires close long-term relationships between the main contractor and the subcontractors. And lastly, there is a need to employ systematic procedures in the selection of subcontractors.

The communication barriers between the main contractor and the numerous subcontractors' organisations should be removed. The subcontractors must be integrated in the decision-making process even before refurbishment projects commence work on site. Latham (1994) suggested that a joint Code of Practice for the Selection of Subcontractors should be drawn up, which should include commitments to short tender lists, fair tendering procedures and teamwork on site.

From the Contractors Proposals document used for tendering for a large refurbishment project, obtained by the author from a large construction company, it was found that the majority of the work contracted by the company is carried out by subcontractors. The computer database in the Buying Departments at head office provides up to date database information on the subcontractors and suppliers. If a subcontractor is new to the company, then the Buying Department will undertake a rigorous check on the subcontractor, which takes into account capability, past performance, quality control, suitability and current capacity. Prior to placing orders with subcontractors, pre-order

meetings are held at which all aspects for the subcontractors are discussed in detail to ensure they are fully conversant with the requirements of the refurbishment project.

#### 4.2.8 Availability of materials

The complexity and uncertainty of refurbishment projects could also be derived from the project environment. Winch (1989) called it environmental complexity and uncertainty. The impact of weather, availability of labour and materials are some of the sources of environmental uncertainties, which can have a major impact on construction activities.

The Chartered Institute of Building (1987) cited the problems of aesthetic, such as of matching new work with old which needs special design and workmanship skills.

The result from the final postal questionnaire survey, which is shown in table 4.11, it was found that only 6.1% of refurbishment projects surveyed faced scarcity of material. The mode is neutral.

Table 4.11 Availability of materials in refurbishment projects

Availability of material	Refurbishment projects (N=66) %
Very high surplus	4.0
Surplus	34.8
Neutral	56.1
Scarcity	6.1
High scarcity	0.0

It should be highlighted here that the refurbishment projects analysed in this study were undertaken during recession. This probably explains why there was a surplus of material in 34.1% of refurbishment projects. In the context of this study, since, the availability of material is not a major concern in the majority of refurbishment projects, it is very likely that it would not affect the planning performance.

It could be concluded that the problems of availability of material tend to be related to economic conditions, rather than inherent in refurbishment projects. Its impact tends to be cyclical and could be reduced. It implies the need for strategic planning of the construction firms involved in refurbishment projects. This suggests the need to maintain long-term relationships between the contractors and their suppliers.

#### 4.2.9 Availability of skilled labour within the vicinity of the refurbishment project

The difference between refurbishment and new build projects is more evident in the degree of intensity of site operations. Quah (1992) observed that refurbishment projects consist of small labour intensive operations scattered throughout the existing building, often with tenants in occupation. There is a lack of 'as built' drawings to guide the designer and builder.

Young and Egbu (1992) described the industry as 'cut and carve' because of the nature of the works. These typically involve the formation of large openings in walls and floors to accommodate new services, strengthening or replacement of floors or even removal of old cladding for new. This was argued to be one of the difficulties faced by planning and control managers, especially in allocating labour resources to achieve maximum productivity. Consequently, as highlighted by the BRE (1990) a refurbishment work tends to proceed as a succession of technical problems that require quick solutions. Frequently, the techniques and methods of repairs have to be uniquely developed for each building, even for similar buildings built in the same period. To plan and monitor for such work is certainly more difficult and requires skilful labour.

The problem is more pronounced in buildings under conservation. This is demonstrated in the refurbishment work carried out by Alfred McAlpine on 17th Century terraced houses at Dombey Street and Orde Hall Street, London WC1. The work required the conversion of the existing houses to provide thirteen flats, four maisonettes and one house. Considerable emphasis had to be placed on the use of traditional detailing and a high quality of workmanship in order that the completed building was sympathetically restored. Careful programming was required to co-ordinate deliveries of materials since access and storage were extremely limited.

Table 4.12 shows that only 6% of refurbishment projects suffer from scarcity of skilled labour. Again, the fact that the refurbishment projects were undertaken during a recession period could explain the surplus of labour in the majority of refurbishment projects.

Table 4.12 Availability of labour in refurbishment projects

Availability of skilled labour	Refurbishment projects (N=66) %
Very high surplus	7.6
Surplus	21.2
Neutral	65.2
Scarcity	6.0
High scarcity	0.0

This result implies that there is a need for the main contractors to rely on the use of subcontractors in order to overcome the cyclical nature of availability of labour. Rigorous selection procedures, close supervision and integration of the subcontractors into the project programme are vital. Employing multi-skilled workers may be an option, but would be more costly.



#### 4.2.10 The impact of weather on refurbishment projects

From the interviews with 37 managers involved in planning of refurbishment work, Young et al (1996) also discovered the impact of weather on refurbishment projects has the least impact on planning efforts and performance among the four uncertainty variables they investigated. In Young et al's (1996) study, the most influential factor was the state of completion of design before refurbishment work commenced, followed by past construction experience of the contractors and the availability of labour.

Young et al (1996) finding is confirmed in this study. As table 4.13 reveals, the impact of weather is low/very low in 57.0% of the refurbishment projects surveyed. This could be attributed to the fact that in the majority of the refurbishment projects, the works were carried out within existing or protective shells. Besides, in many refurbishment projects, protective coverings are normally put around the building to reduce the effect of inclement weather. In refurbishment of 1-4 Eaton square, for instance, a protective covering was even placed over the roof. Thus technological, rather than managerial, appears to be the most appropriate method of handling inclement weather.

Table 4.13 The impact of weather on refurbishment projects

Impact of weather	Refurbishment projects (N=66) %
Very low	34.3
Low	22.7
Neutral	25.8
High	14.6
Very high	4.5

Most certainly, that as far as works on site are concerned, the impact of weather on planning performance of refurbishment projects would tend to be marginal. However,

inclement weather may cause traffic congestion around the refurbishment project site, which may reduce the efficiency of delivery of material and indirectly affect the planning performance of refurbishment projects.

#### 4.2.11 The difficulty of access

In many refurbishment projects, the works have to be carried out in sensitive premises, for examples, embassies and government offices. A contractor undertaking a refurbishment work in such premise needs to take extra precautions to ensure the security of sensitive documents kept on the premise. In addition, on such premise, the client/occupants may impose restrictions on access to certain parts of the buildings and thereby restrict the movement of labour within the building.

This, situation is described by management writers such as Walker (1989) as pooled interdependency whereby the participants involved in a construction project share an independent resource. In refurbishment projects, the failure of the contractor to consider the needs of the client/occupants of the building, would affect the comfort and efficiency of the client/occupants and vice-versa.

Quah (1992) maintained that there is an underlying requirement that refurbishment operations should not interfere with the normal usage of the building. Summers and Fellows (1987) pointed out that when the buildings to be refurbished were occupied, extra precautions were necessary in order to provide dust and noise protection and to ensure effective management and supervision. Often, it is required that the supply of services to the building is not interrupted. These requirements may necessitate the works to be undertaken during unsociable hours, or alternatively, to adopt shift working in which two or three separate teams working at different times of the day.

The refurbishment of the Wardroom and AIB Building, HMS Sultan, Gosport, Hampshire is an example of refurbishment work undertaken in occupied and sensitive premises. The work involved refurbishment of the officers' mess, together with the construction of a single and three storey cabin block, kitchen, administration and interview buildings (AIB).

Refurbishment of the five-wing officers' mess required extensive demolition, and complete modernisation. All work was carried out while existing facilities were kept operational. The contractor had to ensure the security of the sensitive documents in the AIB block and to protect the kitchen from excessive noise and dust.

The CIOB (1987) cited that the difficulty of access to refurbishment project sites could increase the level of uncertainty of refurbishment projects. Many refurbishment projects are carried out within close proximity to other occupied buildings. The client or the owners of the adjacent buildings may set the limit of working space available to work and to store materials. Besides, the client may impose special conditions relating to starting and finishing times due to, for example, security and financial reasons. The provision for access to the site has to take into consideration that the occupants' day to day activities are not interfered with.

To minimise disruptions, some refurbishment projects have to be undertaken on fast-track programmes. The refurbishment of Nuffield House, Guy's Hospital, contract value £3,400,000 is a typical example. New ward bedrooms with bathrooms en suite were added to the four upper floors. The two new operating suites on the ground floor included the latest theatre instrumentation. This complex medical installation was co-ordinated into a 54 week fast-track programme, together with the requirement to keep the adjoining Guy's pharmacy, and tunnel connecting Nuffield House to the other parts of the hospital open throughout the contract.

The extent of difficulty of access to refurbishment projects' site was sought in this study. The result is shown in table 4.14. In 42.8% of the refurbishment projects, access to the site was difficult/very difficult. This group forms the largest category.

This implies the need for the project organisation to be flexible and for participants involved in the planning and control process to react speedily to unexpected events. In a typical refurbishment project, the work has be carried out in small batches and fragments, the 'Just-in Time' approach may be beneficial in refurbishment projects. The difficulty of access means that effective channels of communication between the site, the head office, the subcontractors and client are needed. This could be provided by linking the participants involved in planning and controlling with greater use of information technology.

Table 4.14 The difficulty of access to refurbishment projects site

Access	Refurbishment projects (N=67) %
Very easy	19.4%
Easy	22.4%
Neutral	16.4%
Difficult	24.9%
Very difficult	17.9%

The difficulty of access to the project site is more prevalent in shop and office refurbishment projects. It could be attributed to the tendency of these two types of refurbishment projects to be located in congested commercial areas.

Table 4.15 shows in 57.1% of office refurbishment work, the access to the project site is difficult/very difficult. In shop refurbishment work, 75% were found to be difficult. By contrast, in only 21.1% of residential refurbishment projects, was the access found to be difficult/very difficult.

Table 4.15 The difficulty of access in four types of refurbishment projects

Access to project site	Office (N=28)%	Residential (N=19) %	Hospital (N=4) %	Shop (N=4) %
Very Easy	3.6	36.7	25.0	0
Easy	21.4	21.0	50.0	25
Neutral	17.9	21.1	0.0	0
Difficult	35.7	15.8	25.0	0
Very Difficult	21.4	5.3	0.0	75

Thus the refurbishment of offices and shops tend to require greater co-ordination. Smaller space on site means that fewer trades can work simultaneously at the same location. Thus the project organisation for office refurbishment projects tends to be more fragmented. Since smaller amount of materials can be stored on site, materials can only be delivered in small batches at a time. This necessitates more frequent deliveries of materials.

#### 4.2.12 Availability of space on project site for storage of materials

The difficulty of access tends to be linked to small space for storage of material on the refurbishment project site. The Spearman's correlation technique reveals that difficulty of access is significantly correlated to amount of space for storage of material ( $P \leq 0.01$ ).

In addition, Okoroh (1992) highlighted the difficulties of handling hazardous materials, restricting material supply and the amount of protection required for existing and adjacent buildings. These difficulties are generally considered to be higher in refurbishment projects than in new build projects.

The lack of space, horizontally and vertically was highlighted by Hardy (1979) as one of the factors that contributes to the complexity and uncertainty of refurbishment

projects. Some of the examples quoted by him are the lack of clear eaves height of 18 feet or more, insufficient floor-loading capacities, restricted access with poor loading and unloading capacities, the lack of crane facilities and insufficient car parking space. This may limit the use of big plant and equipment. Thus in many refurbishment projects, the construction trades have to rely on the use of small and hand tools, making it labour intensive and necessitating a higher degree of supervision.

The refurbishment of 1 - 4 Eaton Square London for instance suffered from a very small space for storage of material. To maximise space for this purpose on site, a high level cantilevered platforms, had to be constructed above one of the roads adjacent to the building.

In the case of the refurbishment of Transad House, located in the busy Charing Cross Road, London, the access to the site was so difficult that the only option was to deliver material during unsocial working hours, such as between 6.00 p.m. and 6.00 a.m. This was to ensure that the efficiency of movement on the construction project site and the activities and safety in the adjacent property was not affected. The jib of the tower crane used in the project, which was necessary to reduce the cost of the project, had to oversail the adjacent property. The contractor had to ask the permission of the owner of the adjacent property to let the jib of the tower crane to oversail. The alternative, i.e. using a small mobile crane would have increased the cost.

The amount of space for storage of material in the refurbishment projects was investigated in this study. The result is shown in table 4.16. As table 4.16 reveals, the problem of too small a space to store materials is so common in refurbishment projects.

Table 4.16 shows that the space available for storage of material on site is small/very small in about 63% the refurbishment projects. This is almost 3 times the number of refurbishment projects with large/ very large space. This confirms Egbu's (1994) finding that lack space was one of the most difficult management problems in refurbishment projects.

**Table 4.16 The amount of space available for storage of material on site of refurbishment projects**

<b>Amount of space for storage of material</b>	<b>Refurbishment projects (N=67) %</b>
Very large space	7.5
Large space	14.9
Neutral	14.9
Small space	32.8
Very small space	29.9

Due to confined space in the refurbishment project, great attention must be paid to the preparation of site layout plans. Hence, contractors who have lack of experience and skill in refurbishment works may find it difficult to cope with these additional difficulties. In view of this, Summers and Fellows (1987) concluded that contractors specialising in refurbishment proved to be better able to cope with the difficulties imposed by refurbishment projects than general contractors.

#### **4.2.13 The contracting complexity and uncertainty of refurbishment projects**

Winch (1989) argued that the sources of complexity and uncertainty for construction firms cannot be found at the aggregate level of product market environment but are found within the project, and in the way projects are awarded. He argued that the three sources of complexity and uncertainty outlined above are site specific, derived from the nature of production in construction and could collectively be termed as ‘project uncertainties’. The fourth type of complexity and uncertainty, however, is the result of the way in which the construction process is organised into the contracting system. Winch (1989) called this type of complexity and uncertainty as ‘contracting complexity and uncertainty’.

Winch (1989) argued that the fragmented nature of the construction industry means that functional differentiation tends to be between firms rather than between departments in the same firm. This implies that in the construction process, the interactions between the participants tend to be governed by market rather than by hierarchy. This introduces new problems into the process of integration.

Williamson (1981a: p. 552) maintained that in addition to the costs of production, there are also costs of transaction between parties. A transaction occurs when goods or a service are transferred across a technologically separable interface.

Williamson (1975) stated that in the face of complexity and uncertainty there is a tendency of managers to select convenient and low risk actions rather than to attempt a superior solution. In a refurbishment project, for instance, when all alternatives cannot be fully specified, the ability of managers to take rational decisions is limited, and transaction costs tends to be higher. Also there is a tendency of opportunism among the parties involved in the transactions. This is especially true when the parties involved in the process possess differing levels of information, for instance between the client and the main contractors or between the main contractors and the subcontractors. These problems are further compounded when the parties withhold the information for opportunistic reasons. For instance, when the main contractor withholds information from the client, the transaction cost for the information-deprived client would increase. The cost of achieving information parity is high (Williamson, 1975).

Ball (1980) Eccles (1981), Gunnerson and Levitt (1982) and Winch (1989) argued that competitive tendering induces important sources of contracting complexity and uncertainty. The traditional procurement system, which is normally based on competitive tendering, consists of an obligation on the contractor to carry out and complete the specified works in return for the employer's obligation to pay the agreed price. The contractors have little influence on the degree of completeness of the information provided in the tender documents.



In refurbishment projects, the inclusion of incomplete and uncertain information in the tender document makes it difficult for the contractors to produce estimates accurately. Besides, the uncertainty of getting the contract deters the contractor from putting more effort into gathering more information and deters them from early planning (Hillebrandt 1974 and Lange, 1975). However, once the contractors have obtained the contract, they are then left to carry out the projects with high level of complexity and uncertainty. Because of this, the estimated cost and actual cost of construction projects seldom match. Hence during the pre-bid stage, the transaction cost has to be borne by the main and the subcontractors.

Winch (1989) argued that during the construction stage any change in project specifications opens the door to opportunistic pricing of 'extras' by both the main contractors and subcontractors involved in the projects. There will be negotiations between different parties over variations and claims. The amount of these variations and claims are reflected in the percentage of provisional sum to the project contract value. The transaction cost of this opportunistic behaviour has to be borne by the client. Project complexity and uncertainty, especially task complexity and uncertainty further facilitates this opportunistic behaviour.

In addition, organisational complexity and uncertainty encourages different members of the temporary organisation to manipulate and manoeuvre against each other. Conflicts are more difficult to resolve especially when there is no effective arbitrator.

Robinson (1990) argued that the standard forms of contract developed for new build applications have very little relevance to the complexities and diverse nature of works in existing shells (refurbishment projects). Similarly, Ferry and Brandon (1991) contend that the uncertainties of refurbishment work mean that it will be almost impossible, and certainly inadvisable to undertake the refurbishment project on the basis of lump-sum competitive tenders. This view is supported by Fellows et al (1985) who said that the traditional contractual procedures, which distribute responsibilities

directly between the members of the building team, are inappropriate for refurbishment projects.

The Royal Institution of Chartered Surveyors (RICS, 1982) noted that traditional Bills of Quantities prepared in accordance with the Standard Method of Measurement, are generally not suitable for the average refurbishment project. This view was supported by Hakman (1975) who argued that repair and alteration works have their own special problems and conditions related to the preparation of the Bills of Quantities in a traditional procurement system. The statements made by various writers above imply that to achieve integration in refurbishment projects using a traditional procurement system would be difficult to achieve. It was therefore, surprising to note that almost 90% of all refurbishment projects in the UK used competitive tendering, on a fixed price basis without fluctuations, of these 80% were on full measured Bills of Quantities (Quah, 1986).

However, over the last decade, the UK construction industry has witnessed a growing trend away from the traditional forms of procuring contracts to other relatively new forms (Franks, 1990, 1992; Griffith, 1989; Swanton, 1990; Torrance, 1992). The reasons for the decline includes the issues associated with the separation of design from construction. Some of the issues are listed below.

- Poor communication and lack of integration (Emmerson, 1974; Banwell, 1964 and Sidwell, 1979).
- Increasing complexity of construction processes (Bennett and Fine, 1980)
- Better informed, more professional clients demanding that projects be completed within cost, time and quality criteria (Naoum and Langford, 1990; Bennett and Fanagan, 1983 and Naoum and Coles, 1990).
- Economic changes i.e. inflation and recession (Nahapiet and Nahapiet, 1985a, 1985b and Rowlinson, 1986).

The first three issues listed above are relevant to contracting complexity and uncertainty. The issues are raised partly to alert the construction industry to the disadvantages of the construction processes to be governed mostly by market rather than by hierarchy.

Clegg (1992) notes that contract causes conflict because there are rational occasions whereby the terms in the contract could be interpreted differently by the parties involved and can be exploited by self-interested professionals in the design and construction processes.

Masterman (1988) argued that client dissatisfaction with the performance of traditional methods of building procurement meant that any method where there was single-point responsibility would be welcome. The fixed-price lump-sum tenders would therefore provide extremely attractive options.

Winch (1989) argued that if the designer, the main contractor, and the specialist subcontractors were employed within a same organisation, their relationships would be governed by hierarchy rather than market. Therefore, the way project managers make their decisions would be economised. Hierarchy would greatly enhance feedback when technical problems are encountered and therefore reduce response times when natural uncertainties are met. Hierarchy would also increase the ease by which adjustments could be made in complex and uncertain projects. The advantages of hierarchy for the construction process are essentially the facilitation of feedback loops from the construction to the design process. Hierarchy would economise on opportunism over claims for extras, for the effective completion of a contract would rest within one firm.

Design and build procurement is one such approach that aims to shift the influence of market to hierarchy, which tends to reduce the opportunistic behaviour, and in turn, reduces contracting complexity and uncertainty. Masterman (1988: p. 55) defined the term of design and build as an arrangement where one contracting organisation takes

sole responsibility, normally on a lump sum fixed price basis, for the bespoke design and construction of clients. There are a number of variants to design and build (CIOB, 1988) which is typified by the Standard Form of Building Contract With Contractor's Design 1981.

In the design and build, the integration of design and construction could lead to savings in time and provides a clear line of redress if technological and contractual difficulties arise. It also increases efficiency through improved communication. The design and build procurement system encourages negotiations and conflicts to be resolved within an integrated construction firm and is, therefore, structured in the interest of the client. It is increasingly common to find contracts under which the contractor undertakes full or partial responsibility for design.

Thus there are strong reasons to believe that the design and build procurement system is the best option available to the construction industry to reduce complexity and uncertainty in construction projects. Therefore, it is not surprising to note that the design and build is the fastest growing procurement system in the UK (Franks, 1992; Cheetham and Jaggar, 1990 and Contract Survey, 1989).

A thorough review of literature failed to obtain the data on the types of design and build contracts used for refurbishment projects. Bound and Morrison (1993) conducted a survey on contracts in use in the UK construction industry for the period of January to December 1991. The survey excludes overseas work, civil engineering, heavy engineering term contract, and repair and maintenance contract.

Only two design and build forms were listed in the survey, the NFTBE design and build (1974) and the Employer or QS written. Of the two, the Employer or QS written form was more popular which constitutes of 4.4% of the total number of contracts included in the survey. Only 0.13% of the contracts surveyed used the NFTBE design and build (1974).

Franks (1992) however estimates that about 35% of non-industrial and non-housing turnover in the UK construction industry use design and build contracts, which accounts for far more than the percentage obtained by Bound and Morrison (1993). When industrial and housing turnover are included, the percentage is close to 45%. Frank (1990, 1992) and Griffith (1989) have shown that design and build has been growing at an average rate of 15% per annum. Following this trend, these reports predict that by the year 2000, over 50% of the construction works in the UK will be procured through the design and build.

Young et al (1996) maintained that design and build is firmly established as a procurement option in the UK construction industry, and predicted its use to increase further. The heavily contractor-marketed characteristics ensured that the growth in use of design and build system in turn produced one of the most significant trends in construction procurement in recent years. Young et al (1996) maintained that with an increasing trend toward design and build contracts, planning and control managers and their organisations would need to be more knowledgeable about this procurement system. This is necessary if they are to remain competitive, and to provide the kind of services which their clients demand.

From the preliminary postal questionnaire survey conducted in this study, nearly 75% of the construction firms responded that they have experience in using design and build procurement system for refurbishment projects, making it the second most widely used, after the traditional procurement system (see appendix F).

Table 4.17 shows that 57(85%) the refurbishment projects obtained in this study used traditional procurement system, almost six times more than those using design and build 10 (15%).

Table 4.17 also reveals that refurbishment projects using traditional procurement system tend to be smaller in size. There are 51% of the refurbishment projects using

traditional procurement system of contract value below £1.5m. In contrast, 60% of the refurbishment projects using design and build were above £4.0m.

Table 4.17 The frequency of distribution of project size and in traditional and design and build procurement systems

Project size	Traditional (N=57) %	Design and build (N=10) %
£0.5 - £1.0	26.3	0.0
£1.1 - £1.5	24.6	20.0
\$1.6 - £2.0	14.0	20.0
£2.1 - £2.5	7.0	0.0
£2.6 - £4.0	2.6	0.0
More than £4.0	24.6	60

It could not be confirmed from the literature review that refurbishment projects using design and build procurement system tend to be larger. The author could only obtain data from the Royal Institution of Chartered Surveyors survey (1991) which show the contract values of new building projects using various types of procurement system. The results are shown in table 4.18. The table reveals that the building works using design and build contributed only 4.3% in terms of number, but in terms of value it contributed 10.6%. Therefore both the results of this study and the RICS (1991) indicate that design and build procurement system tends to be used for larger (hence more complex and uncertain) construction projects.

Table 4.18 The contract in use

Procurement systems	% in terms of number of projects	% in terms of output of new projects
JCT 1980	25.8	44.2
JCT 1963	5.2	2.7
Minor works	28.6	2.6
IFC 84	16.4	8.2
Design and Build	4.3	10.6
Management	1.2	14.6
Construction Management	0.2	6.7
Other forms	18.2	10.4

*Source: Contract in use, the Chartered Quantity Surveyor, January 1991.*

The results obtained from this study and from the RICS however contradict the findings of Fellows et al (1985). Skitmore et al (1985) found that the design and build procurement system tends to be used for less complex project. It could be argued that since the early 1980s, an increasing number of construction firms, especially the larger ones are becoming more familiar with the design and build procurement system. Increased knowledge and familiarity of the parties involved in the construction industry, coupled with pressures from the client, tend to increase the use of design and build in larger construction projects.

There is a very strong possibility that, since larger refurbishment projects are normally associated with higher complexity and uncertainty and therefore greater risk, the design and build procurement system was preferred by the client because single point responsibility lies within the contractors organisation.

Despite the perceived advantages of design and build, table 4.18 reveals that traditional procurement system is more popular. Most probably, the familiarity of the

client and clients' consultants enable this procurement system to maintain its popularity. In addition, the design and build has its limitations. Griffith (1989) maintained that with the contractor being responsible for the design and construction, clients are at risk when the contractor does not fully appreciate the risk associated with design. Similarly, the client is at risk if the contractor does not have full indemnity insurance cover.

From the semi-structured interviews conducted by the author, a planning and controlling manager claimed that design and build is less suitable than traditional procurement system in refurbishment projects because the contractors have to take greater risks and could not claim for variations.

This comment should direct the attention of the proponents of the design and build for two reasons. Firstly, the high risk may be shifted too far to contractors. Secondly, in complex and uncertain refurbishment projects, the contractors may be reluctant to undertake such projects without allocating substantial amounts in the tender bids for contingencies, insurance and profit margin. In such instances, the client could not reap the benefits that a design and build procurement system could offer.

Despite the argument that construction processes are best governed by hierarchy than market, the trend has been towards market governance with the emergence of management contractors and the retreat of main contractors from actually doing any site work (Winch, 1989). In management contracting, the main contractor is part of the client team.

Within this contracting system, the firms tend to be organised on a basis of pooled interdependency (Thompson, 1967) where each firm shares overheads with other firms involved in the project. The contractor is involved in co-ordinating the design with the construction of the project, but does not perform the function of a designer. The contractor's role is strictly that of management (CSSC, 1989). In management contracting, the contractor is appointed as the consultant to give a construction



management service in return for reimbursement of a fee and prime cost basis (Naoum and Coles, 1990). The management contractor is therefore part of the client's team, carrying out total management function in partnership with other members of the client team. Fellows et al (1985) observed that management contracting was used frequently when time is the priority.

Naoum (1994) discovered that management contracting procurement in some cases reduced the problems of complexity and uncertainty in refurbishment projects. A refurbishment project, as described by a management contractor interviewed by him, tends to consist of the sum of a number of 'work packages', which are initially not described, in adequate detail. The characteristics of a management contract require tackling the job by subcontracting all the work. When the information given to the subcontractors is inadequate, the project needs to be organised in a more flexible manner to facilitate adjustments between subcontractors due to constant changes in design made during construction. Management contracting was considered to allow greater flexibility to incorporate changes made in design during construction. While the scope of work packages become more definite as the project progresses, under management contracting each element of the refurbishment work can be efficiently designed according to client requirements. This benefit can be more effectively utilised when the refurbishment job is large and highly complex.

This view is supported by a client interviewed by Naoum (1994) who argued that management contracting was more suitable in refurbishment jobs because many changes need to be made during construction.

Torrance (1992: p. 251) however argued that: 'one of the weaknesses of management contracting is that there is no standard approach and there is no standard appreciation of the roles and responsibilities. It is imperative that the various parties understand their roles and responsibilities to ensure that the efficiency of the operation is not affected and dispute resolutions do not become more complicated'.

Wilson (1993) therefore suggested that the client has to decide the roles and responsibilities of the various parties in order to have a balanced team. Fellow et al (1985) cited that the drawback of management contracting is that it does not provide sufficient incentives to contractors to complete the project on time and suggested that it necessitates stringent client control.

Naoum (1994) highlighted the view of a national and international banking client who cited the limitations of management contracting. The client did not see management contracting as the best method for the majority of its work, because it was not suitable for small jobs. In the client's case, the premises had to be occupied while construction was in progress. Therefore with little packages the job would be too 'messy' and would need greater interaction between the client, the main contractor and the subcontractors.

Naoum and Langford (1987) in their study of management contracting observed that few firms are operating management contracting successfully and suggested that appropriate management skills and knowledge need to be enhanced. Bale (1985) suggested that further improvements in the general level of competence are needed if management contracting is not to be discredited by poor application.

Thus the success of management contracting depends on the level of knowledge of the client. The client needs to be well informed on issues relating to the construction projects and possess a high level of management skills. In other words, in order to reduce complexity and uncertainty, the client has to strive for information parity with all the parties involved in the process. But Williamson (1975) has argued the cost of achieving information parity is high.

From the statements made by the various writers above, it could be argued that in most instances, it is very unlikely that management contracting could offer significant contribution in reducing the contracting complexity and uncertainty of refurbishment projects.

It is not surprising therefore this study discovers that the use of management contracting in refurbishment projects is still low. The preliminary postal questionnaire survey reveals that less than a fifth of the construction firms had experience in undertaking refurbishment projects using management contracting.

Project management procurement system is probably the best option to overcome the sparsity of knowledge of the majority of the clients in the construction processes. It is a distinct procurement system, where the client employs an organisation to carry out all the necessary functions to procure the building. A project manager is employed by the client with all the necessary powers to achieve that aim (Hamilton, 1990).

Hamilton (1990) viewed that project management may be attractive to clients who choose not to be closely involved in the procurement process and prefer the single point of contact through the project manager. This could be seen as an attempt to increase the level of knowledge of the client to be on a par with the contractors.

Probably, the lack of trust between the client and the main contractors provides the greatest impetus for selecting this procurement system. However, by employing another organisation or function adds extra layers into the system and thus generates transaction costs. This arguably, would render the system to be more complex and uncertain.

From the preliminary postal questionnaire survey it was found that only a fifth of the 103 construction firms responded, have experience in carrying out refurbishment projects using the project management procurement system (see appendix F). The construction firms are mostly large construction firms. This implies the knowledge and experience on this procurement system are still limited and the construction firms using this procurement system are specialised.

The availability of various procurement systems, on the one hand, provided greater choice for the client, but on the other hand, caused confusion. Hughes (1992: p. 105), for instance noted that 'the construction industry and its clients are still trying to sort out reliable methods for procuring construction'.

Few would disagree that, the selection of the appropriate procurement system for each construction project is vital. Several studies have been conducted, attempting to set out criteria and guidelines in choosing a procurement option for a given project (Ireland, 1985; Hamilton, 1987; Skitmore and Marsden, 1988; BEC 1987). Expert systems have also been developed to provide guidance on the most suitable procurement system for given set of circumstances (Brandon, 1990; Brandon et al, 1988). However, Ireland (1985) maintained that no mutually exclusive sets of criteria uniquely and completely determine the appropriate procurement system for a specific project.

In response to contracting complexity and uncertainty, Ball (1980) and Winch (1989) state that the construction industry places greater emphasis upon flexibility than efficiency. Contractors increasingly subcontract a large proportion of the work. This tends to create greater complexity and uncertainty for construction projects. Though contracting complexity and uncertainty will always exist (Ball, 1980, Eccles, 1981 and Gunnerson and Levitt (1982) and Winch (1989) state that attempt must be made to reduce them. Ball (1980) argued that a procurement system and contract must be chosen to acknowledge complexity and uncertainty and to justly reward extra work undertaken.

Still, many authors maintained that the types of contract chosen for construction projects have resulted in clients' dissatisfaction, with widespread disputes and conflicts over apportionment of risks and time overrun of projects (Fenn, 1991 and 1992; Clegg, 1992 and NEDO, 1991). Fenn (1991) has shown that construction litigation had increased in recent years.

Latham Report (1994) suggests that in order to reduce adversarial relations between client and contractors, advice should also be issued on partnering arrangements.

Partnering is a voluntary arrangement between two or more partners (it is not in a form of contract) to achieve mutual business objectives involving trust and integrity, effective communication, regular review, evaluation and feedback resulting in a win/win outcome (Watson, 1997). It brings the client into the team. It can be implemented at the concept, pre-tender and post tender stages. It can be applied to specific projects, longer-term arrangements or strategic sourcing agreements. It does not impinge on any standard of contract.

According to Watson (1997) the easiest point for the client to introduce partnering is at the pre-construction/post-contract tendering stage, when the lowest bid has been accepted. Then the client and the winning contractor can discuss and assess the risk and the price it attracts. Sir Michael Latham in his report quoted potential project savings of 2-10% from adopting this approach.

However, it could be argued that since partnering is not a legal arrangement, more likely the partners involved will revert to the traditional opportunistic behaviour when things get tough. This might deter the clients or the contractors to become partners in complex and uncertain refurbishment projects.

There is also difficulty in distributing the cost saving. Sometimes the client takes a much bigger share of the savings and the contractor has to be satisfied with securing continuity of work. This might be acceptable when the work is scarce. The contractors might not be interested when the workloads rise. Therefore the client has to ensure that contractors should get some benefit from the cost savings to ensure partnering deals continue workings as the economy improves.

#### 4.3 The associations between situational variables and refurbishment planning performance variables

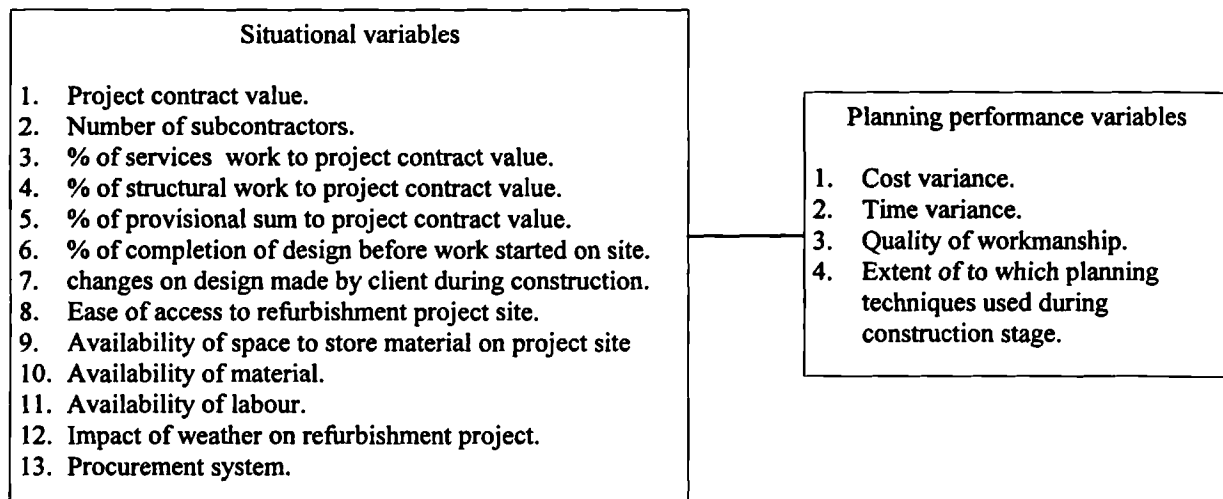
The situational variables of refurbishment projects and their implications have been discussed. The various integrative mechanisms to deal with the situational variables in order to improve planning performance have been suggested.

Mohsini and Davidson (1992) maintained that uncertainty, i.e. the sufficiency of the starting information and the extent of task-interdependence affects the aggregate performance in traditional building process. The issue that needs to be addressed here is to what extent the situational variables influence the planning performance of refurbishment projects.

It could be argued that some of the situational variables are relatively easy to manage by the options already suggested, hence their influence on planning performance is insignificant. It is imperative for refurbishment project organisations to identify the situational variables that are strongly associated with planning performance. This will enable them to employ the most appropriate integrative mechanisms in the planning and control process and use resources more efficiently.

To detect the relationship between the situational variables and planning performance, the Spearman's correlation technique was used. The independent variables are the situational variables and the dependent variables are the planning performance variables. The independent and dependent variables tested are shown in figure 4.1

Figure 4.1 The situational variables and the planning performance variables



The null hypothesis is that there is no association between the situational variables and the planning performance variables. The null hypothesis is rejected at 0.05 significant level.

It should be pointed out here that the situational variables were coded in ascending order. Higher code indicates higher level of complexity and uncertainty. For instance, for difficulty of access, the scale of very easy (the least complex and uncertain) was coded 1 and very difficult (the most complex and uncertain) was coded 5.

The planning performance variables were coded in descending order from high to low performance. For, quality of workmanship for instance, 1 indicates very high quality of workmanship and 5 very low quality of workmanship. Positive correlation values would indicate the greater the complexity and uncertainty of situational variables, the lower the planning performance. The results are shown in table 4.19.

Table 4.19 The associations between the situational variables and the planning performance variables

Situational variables	Cost variance	Time variance	Quality of workmanship	Extent of monitoring♣
Project contract value	.04	.00	-.04	-.28*
The number of subcontractors	.04	.00	.04	-.10
The value of services work as percentage to contract value	-.05	-.24	.02	.06
The value of structural work as percentage to contract value	.06	.02	.07	-.03
The value of provisional sum as percentage to contract value	.33*	.12	.16	.10
Design completeness before construction work commenced on site	.17	.06	.07	.02
Changes made by client during construction	.16	.21	-.04	.06
difficultye of access to site	.24	-.06	.24	.05
Space for storage of material on site	.23	.03	.08	.06
The availability of labour	.06	.09	-.03	-.13
The availability of material	.12	.20	.13	.10
The impact of weather	.07	.11	.02	.06
The types of procurement system	.18	.19	.16	.06

\*significant at 5% level

\*\* significant at 1% level (two- tailed test)

♣ The extent to which the planning techniques were used for monitoring during construction.



Table 4.19 shows the correlation values are mostly positive. This was expected as the higher the degree of complexity and uncertainty of the situational variables, the more difficult to plan and control, hence the lower the planning performance. However, there are only two significant correlation coefficients. The most plausible explanation is that the influence of the situational variables on planning performance is moderated by intervening variables, such as integrative mechanisms employed by refurbishment project organisations.

The percentage of provisional sum to project contract value is significantly associated with cost variance. This result was expected. In fact, it provides an indication to the reliability of this study. The provisional sum is the value allocated for work with insufficient information. The value could only be ascertained once the work had been completed during construction stage. This result gives credence to the argument that more information should be gathered at the early stage of refurbishment projects to narrow down uncertainty. This may require the involvement of contractors during the design stage, which implies that design and build is more appropriate in refurbishment projects. The Kendall's tau-b technique found that the refurbishment projects using a design and build procurement system had a lower percentage of provisional sum than those using traditional procurement system (correlation coefficient of 0.45 at 0.01 significant level).

Considering that the refurbishment projects using a design and build procurement system were larger projects, this finding is useful to the client. The decrease in content of provisional sum in the refurbishment project, would help the client to reduce administrative work, effort spent in supervision and reduced cost variance.

Table 4.19 shows that the larger the refurbishment projects, the greater the extent of planning techniques were used for monitoring. This was expected. Larger refurbishment projects require closer monitoring. Planning techniques are important tools to detect deviations that are more likely to occur in larger refurbishment projects.

It must be pointed out, however, that larger refurbishment projects tend to be undertaken by larger construction firms. The Spearman correlation technique shows

that the association between the project contract value and construction firm size is significant, (correlation coefficient of .57 at 0.01 significant level). The larger construction firms tend to have more resources to plan in greater detail and use sophisticated computer software to prepare and revise the planning techniques. The planning techniques tend to be more accurate, which encourages greater use.

With only two significant correlations between situational variables and the planning performance, it could be argued that the association between situational variables and planning performance is generally weak. Faniran et al (1994) also discovered only a few correlations between construction project complexity and uncertainty and planning performance. There is a plausible explanation. This could be attributed to the emphasis and the success of refurbishment project organisations in managing the situational variables. For instance, the impact of services work on cost variance has been well documented. The increased level of awareness to its impact has led many construction firms to take specific measures such as creating special task force for handling services work. This has been highlighted in section 4.2.6.

The design and build procurement system which has been hailed to provide much greater integration is found to perform better than traditional procurement system, albeit insignificantly. Considering that the refurbishment projects using design and build procurement system are significantly larger in size, and arguably, more difficult to plan and control, the result is of considerable interest here. Due to the small number of refurbishment projects using design and build, the author, considers that it is more appropriate to compare the planning performance of two procurement systems by using descriptive statistics. The results are shown in tables 4.20 to 4.23.

**Table 4.20 The cost variance of refurbishment projects using the traditional and design and build procurement systems**

Cost variance	Traditional (N=50) %	Design and build (N=10)%
Less than 0.95	30.0	50.0
0.96- 1.05	34.0	40.0
More than 1.05	36.0	10.0
Total	100.0	100.0

**Table 4.21 The time variance of refurbishment projects using the traditional and design and build procurement systems**

Time variance	Traditional (N=54) %	Design and build (N=10)%
Less than 0.95	13.0	30.0
0.96- 1.05	53.0	60.0
More than 1.05	34.0	10.0
Total	100.0	100.0

**Table 4.22 The quality of workmanship of refurbishment projects using traditional and design and build procurement systems**

Quality of workmanship	Traditional (N=56) %	Design and build (N=10)%
High	39.0	60.0
Neutral	50.0	40.0
Low	11.0	0.0
Total	100.0	100.0

**Table 4.23 The extent to which the planning techniques were used for monitoring during construction of refurbishment projects using the traditional and design and build procurement systems**

Extent of use	Traditional (N=56) %	Design and build (N=10)%
High	29.0	40.0
Neutral	49.0	40.0
Low	22.0	20.0
Total	100.0	100.0

In all four planning performance variables, the refurbishment projects using the design and build appear to perform better than the refurbishment projects using traditional procurement system.

In terms of cost variance, 50% of refurbishment projects using design and build procurement system have a cost variance 0.95 or less. By contrast only 30% of the refurbishment projects using the traditional procurement system, have a cost variance of 0.95 or less.

In terms of time variance, 30% of refurbishment projects using design and build have time variance of 0.95 or less. The corresponding value of refurbishment projects using traditional procurement system is 13%.

In terms of quality of workmanship, 60% of refurbishment project using design and build procurement system have high quality of workmanship. In traditional procurement system, only 39% have a high quality of workmanship.

In terms of the extent of planning techniques being used for monitoring during construction, again the refurbishment projects using design and build appear to perform better. In 40% of refurbishment projects using design and build, the planning techniques are highly used for monitoring. The corresponding number for traditional procurement system is 29%.

#### 4.4 Conclusions and recommendations

The situational variables (or complexity and uncertainty variables) of refurbishment projects have been identified and measured. Out of 67 refurbishment projects, 56% are of contract value of more than £1.6 million pounds and 85% using traditional procurement system.

The majority of the refurbishment projects surveyed in this study are characterised by the following: -

- Commenced on site with only 80% of design complete.
- Suffer from extensive changes in design during construction stage.
- Small space for storage of material on site.
- In 43% of refurbishment projects, access to the site was found to be difficult/very difficult.
- The mode for services work relative to contract value in the refurbishment projects is more than 35%. The mode for structural work and provisional sum is less than 10% of the contract value.
- Only 28% of refurbishment projects suffered from high impact of weather. A very small percentage of refurbishment projects suffer from scarcity of skilled labour (6%) or scarcity of material (6%).

It has been pointed out that the situational variables have many implications on the planning and control process of refurbishment projects. It has been suggested that the complexity and uncertainty derived from the situational variables require refurbishment project organisations to employ various integrative mechanisms to increase information-processing capacity. This will moderate the impact of the

situational variables on planning performance. The planning and control process of refurbishment projects may require the deployment of a combination of integrative mechanisms of varying degrees to increase planning performance.

With only two significant correlations between situational variables and planning performance variables, it could be concluded that the complexity and uncertainty could be moderated and managed by increasing information processing capacity in the planning and control process of refurbishment projects.

There are strong indications that refurbishment projects using design and build procurement system perform better than refurbishment projects using traditional procurement system.

It is recommended research on refurbishment projects using management contracting and project management procurement systems should be conducted. This will help the construction industry to determine the most appropriate procurement system to be used for refurbishment projects with varying degrees of complexity and uncertainty.

## **Chapter 5**

### **Decision-making in the planning and control process**

#### **5.0 Introduction**

The main emphasis in project planning literature, training and education is on the techniques of project planning and control, and in particular those concerned with scheduling of work and cost estimating (Howell, 1990; Laufer et al 1994 and Harrison, 1992). This tendency is largely attributed to the influence of the owner, the goals of construction projects, and the training of construction planners. However, there is much more to project planning and control than the use of those techniques. Laufer et al (1992) for instance maintain that more emphasis should be placed on the area of the planning process, i.e. on the integration of interrelated decisions made by various participants. The studies conducted by Cohenca et al (1994), Cohenca et al (1989), Faniran et al (1994), Laufer et al (1993), Laufer et al (1994) Syal et al (1992 ) are the most notable studies in this area.

The review of literature also reveals that research on the planning and control of refurbishment projects is still sparse. In the area of planning techniques, only studies conducted by Whiteman et al (1988) and Feidler (1987) are of considerable interest. In the area of the planning and control process, the study conducted by Young et al (1996) is the only notable one.

The higher the uncertainty of the construction project, the more difficult to plan and control and the less effective articulating actions and outcomes. According to Laufer (1994) sophisticated models for planning and control are inadequate for coping with high uncertain project situations. This situation poses difficulties for refurbishment project organisations when making strategic choices on goals, organising modes and for

integrating individuals in the organisation. Finally, managers involved in a construction project have to decide whether goals, the project organisation, individuals or some combination of them should be changed in order to adapt to the environment. Organisation design is concerned with maintaining coherence of these intertwined choices (Galbraith, 1977).

According to Walker (1989) the complexity of clients' demands, the complexity of building and other constructional works and technological developments, have over the years resulted in specialisation within the construction industry. The specialisation of tasks tends to cause differentiation, in which the organisation is divided into distinctive sub-systems and sentient (Lawrence and Lorsch, 1967). The large number of specialists who contributed to the decision-making process reflects the existence of differentiation in construction process.

Galbraith (1977), Simon and March (1958) and Cyert and March (1963) suggested that much of what goes on in organisation is decision-making and information processing. The large number of people involved in the decision-making process is reflected by their limited ability to process information.

Decision-making is universally accepted as the central role of management (Buffa, 1976). Simon (1960) went further by saying that decision-making was synonymous with management. Dermer (1977) also pointed out that the essence of planning is collecting information and making decisions. Hence, it is important for this study to examine the decision-making process in the planning and control of refurbishment projects, especially the relative involvement of the various parties in decision-making. From this examination, this study will be able to establish the areas of the decision-making process that need to be improved in order to increase planning performance.

Laufer et al (1994) noted that planning is a mentally demanding and complicated process. Construction planning is particularly difficult. It has to be done under constantly changing conditions, much of it being carried out during project execution,



with insufficient and incomplete information. Construction planning is also very time consuming, especially when the process involves systematic gathering of external data, such as availability, cost and productivity of construction resources.

Walker (1989) suggested that the best way to manage the complexity and uncertainty of construction projects is by greater integration of decision-making among the key participants. Integration is a concept put forward by Lawrence and Lorsch (1968: p4) who defined it as ‘the extent to which the activities of individuals are closely co-ordinated in relation to the project objectives’. It is facilitated by effective formal channels of communications and through reliable and accessible information for staff about their jobs and their firms (Marsh and Simon, 1958; Burns and Stalker, 1961; Lawrence and Lorsch, 1968 and Galbraith, 1973). Effective channels of communications and reliable and accessible information could be achieved by involving the key participants in decision-making (Walker, 1989).

The degree of integration in the planning and control process of refurbishment projects is measured in this study. It is determined by measuring the relative degree of involvement of the key participants in decision-making at the pre-bid, pre-construction and during the construction stages of the refurbishment projects.

The objectives of this chapter are:

1. To establish the relative degree of involvement of the participants in decision-making in the planning and control process of refurbishment projects.
2. To establish the relationships between the degree of involvement of key participants in decision-making in the planning and control process and the planning performance of refurbishment projects.

## 5.1 Definitions of planning and control

The term planning is still widely debated (Wildavsky, 1973; Mintzberg, 1981; Snyder, 1982 and Duncan, 1996). Koontz (1972) in his broad definition of planning, for example, defined planning as a process of deciding what to do and how to do it before an action is required.

Laufer et al (1994: p. 54) in his attempt to show the main components of construction planning, agreed with Koontz (1972) that decision-making is an essential element of planning, but further added that in reality apart from decision-making, planning 'accommodates most' of the elements listed below:

1. A decision-making process.
2. A process of anticipatory decision-making - to decide what and/or how to perform actions due at some point in the future.
3. A process of integrating interdependent decisions into a system of decisions.
4. A hierarchical process evolving from general guidelines to objectives, to the elaboration of means and constraints that lead to a detailed course of actions.
5. A process that includes part or all of a chain of activities comprising information search and analysis, development and design of alternatives, analysis and evaluation of alternatives and choice making.
6. The systematic employment of procedures (standardised and formal to varying degrees).
7. Documented presentation, in the forms of plans.

The suggestion of 'accommodates most' instead of 'all of the elements' renders Laufer et al's (1994) definition of planning too flexible. This definition could help to avoid controversy, but on the other hand introduces ambiguity.

The Project Management Institute (PMI, 1996) pointed out that on many high-technology projects (e.g. aerospace, biosciences, electronics, software-development projects), the term 'planning' includes any and all activities needed to create a project plan: scope definition, costing, scheduling and staffing. The Chartered Institute of Building, (CIOB, 1991) however, considered staffing and organising to be separate from planning. Since various management writers could not agree on the definition of planning, the PMI (1996) advised to use the word 'planning' with a clarifying modifier.

Duncan (1996) defined control as monitoring performance and taking action when necessary to ensure progress. There were fewer disagreements relating to control's definition. Various writers provided almost similar definition (Bennett, 1991; Harrison, 1992, Jackson, 1986).

Control is fundamentally important in management. A sensible working definition of managers could be: 'people who control the work of others in order to achieve planned objectives' Bennett (1991: p. 292).

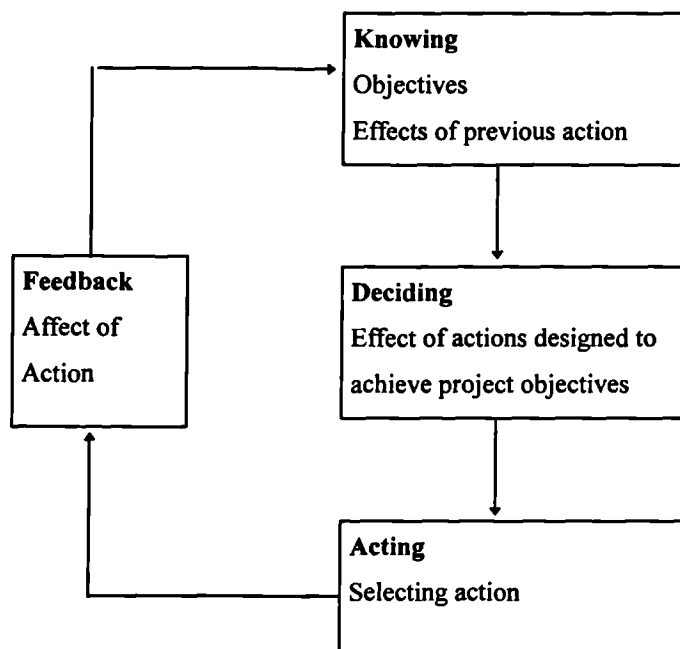
Various project management writers concurred that planning and control are integrated into a single process and cannot be separated (Jackson, 1986; Koontz and O'Donnel, 1972; Koontz et al 1986; Laufer et al 1994; Ackoff 1970; Harrison, 1992 and Bennett, 1991).

Jackson (1986) maintained that separation of these two processes is difficult in construction where different groups of people may be responsible for both functions. Koontz et al (1986) said that without objectives and plans, control is not possible

because performance had to be compared with some established variables. The shift from planning to control maybe imperceptible (Koontz and O'Donnel, 1972).

Figure 5.1 is an illustration produced by Bennett (1991) to show how planning is intrinsically linked to control.

Figure 5.1 The link between planning and control



*Source: Bennett, J. R (1991) International Project Management*

According to Bennett (1991), the diagram above should be regarded as a universal model that encompasses both planning and control. Once the overall objectives are given, planning is indistinguishable from control.

Many management writers concurred that there is not much benefit in distinguishing planning from control. (Bennett, 1991: p. 293) however pointed out that perhaps there is a justification to distinguish planning from control by saying that;

‘Planning is often associated with long-term and large scale activities, while control is used to refer to short-term and small scale sub-activities. Hence, planning is associated with strategic activities while control is associated with tactical activities. A construction project manager, for instance, needs a strategy for an overall plan of campaign and tactics to deal with immediate crises. Therefore, a sensible view of control is that it is neither more nor less than short-term planning. Nevertheless, this distinction is not really useful as the way they think about and decide an appropriate actions cannot be subdivided usefully into planning (strategy) and control (tactics)’.

If Bennett’s (1991) argument is accepted, it would then be possible to describe the planning and control process as a long-term and short-term planning process. In this way, the distinction between planning and controlling would no longer be necessary. (Harrison, 1991) also argued the difficulty for drawing distinction between planning and control and said that planning launched a project, but launch planning is the dominant function of project management for perhaps only 20 per cent of the project life cycle. When a project is launched, control becomes the dominant functions for the remaining 80% of the project life cycle. Indeed after the launch phase, planning and control merge through the ‘control cycle’ into one integrated managerial function.

Harrison (1991) provides an answer for those who wanted to escape from the controversy by saying that, the trend today is to refer to project planning and control as the management of cost, resources and time, or more simply project control. All the activities and organisational units involved are brought under the umbrella of project control.

Due to the difficulty in distinguishing between planning and control, some writers on these subjects preferred to use either the term planning or control to describe both processes. Laufer et al (1992) for instance, used the term planning to include short-term (i.e. foreman) planning. Bennett (1992) other hand, used the term control to describe both processes, planning and control. The preference for some authors to use either the

term planning or controlling when they meant both is unfortunate, because it hinders the author from being consistent in the use of terminology in this thesis. The author believed that in order to overcome the problem of inconsistency in the use of terminology, whenever possible, to follow the approach employed by Harrison (1992) using 'planning and control' as a term.

However, when direct quotations are made from various writers in this thesis, the inconsistency in the use of the terms 'planning' and 'control' cannot be avoided. It is therefore useful for the readers of this thesis to bear in mind that the two terms are used interchangeably.

In the context of this study planning and control is defined as a process to decide future actions, by integrating interdependent decisions made by various participants, systematic employment of formal and informal procedures and the presentation and monitoring of plans.

Harrison (1991) identified two elements of planning and control. The first element is what he called project planning and control process. It is the mechanism to enable the project manager to take decisions, allocate resources and carry out actions. The second element is what he termed project plan or plans. The project plan or plans are the end result of the project planning and control process.

According to Mintzberg (1990) formalisation is an important element in planning. Formalisation means the decomposition of a process into clearly articulated steps. Planning is thus associated with formal and rational analysis. A flexible plan, according to Mintzberg (1994: p. 12) is 'like a progressive Conservative (or a civil engineer), is thus an oxymoron. Plans may not engender human commitment, but they do commit organisations'.

This view is supported by Nahapiet and Nahapiet (1985 p. 18) who said 'Project planning and control is the formal systems, such as systems with their associated

information and reports. The function of planning and control system is to provide a mechanism for co-ordination in construction project. Their main purpose is to specify a blueprint for action, which can be easily monitored and appropriate action taken should deviation occur. Once implemented, these blueprints are intended to establish responsibilities in such a way that there is little need for further communication between task performers'.

The main concern here is that in order to strive for formalisation, there would be a tendency for planners to concentrate on planning techniques, the formal presentation of the planning and controlling process. Mintzberg (1994: p.19) was vehemently against this tendency by saying that, 'someone once quipped, in science, as in love, a concentration on technique is likely to lead to impotence.'

Steiner (1979) agreed with this view and argued that injecting too much formality into a system would cause inflexibility, rigidity and complexity and restrains creativity. This view is also supported by Lewis (1969: p17) who said;

'Planning by direction has to be inflexible. Once the planning specialists have made the thousands of calculations that are necessary to fit the plan together, and have issued their directions, any demand that any of the figures be revised is bound to be resisted. That plan once made must be adhered to simply because you cannot alter any part of it without altering the whole, and altering the whole is too elaborate a job to be done frequently.'

The above statement implies that conflicts would tend to occur if the participants involved in planning and control consistently rejected the formal planning mechanism made by the planning specialists by making intuitive decisions.

The concern is that formalisation could discourage insight and synthesis and create inflexibility. And yet, flexibility is also important element of planning. There is a need to reconcile these conflicting objectives.

Mintzberg (1994b) suggested a way to overcome the pitfalls caused by formalisation. Formal analysis must be coupled with intuition to ensure the best of human thinking. Staff planners must co-operate with line manager to ensure effective strategy making. But this can only happen only when each appreciates the competencies and possibilities of others. For planners, this means an appreciation of informal visionary and learning together with a willingness to adapt their approaches to make them compatible with these processes. This statement could be interpreted that decisions must take place alongside formal procedure and continuous involvement of the people with different competency necessary in the planning and control process.

Ansoff (1994) also articulates the need for the participation of people of different competency in planning, especially in an uncertain environment;

‘In practice, general managers and implementers participate in developing plans, staffs play catalyst roles, the planning process is coupled with the design and management of discontinuous organisational transformation, the planning process blends creativity and rational analysis, the inevitable organisational resistance to change is anticipated and managed, and the key impact of the key managers’ mindset and of the organisational culture is anticipated. All the above variables must be included in attempts by firms to succeed in the turbulent, unpredictable and rapidly changing environment in 1990s’.

Ansoff (1994: p. 31)



## 5.2 Functions of project planning and control

The main functions of planning and control are to ensure the ability to respond to future changes (Laufer, 1994) and to provide efficiency, motivation and integration of a project. (Harrison, 1991).

According to Harrison (1991) planning and control would ensure that the works required to complete a construction project would be sequenced and scheduled in a logical and efficient manner. During the planning and control process, total cost and total time of a construction project could be estimated. Also, a time phased budget and cash flow could be constructed. Within the process, schedule, resource and cost plans could be integrated into the construction project organisation.

Undoubtedly, the planning and control process could provide motivation to the people involved in a construction project, which in turn could improve planning performance. The process gives people targets to guide them to perform well and provides them with feedback on their performance. Thus planning and control could be used to promote time and cost consciousness, in that everyone would know their own personal targets and be motivated to achieve the targets within the overall project plan.

The planning and control process provides mechanisms to integrate the many diverse elements and firms. Planning and control could be used to develop co-operative working relationships and even teamwork, by making explicit the interrelationships and interdependencies of the people and groups involved, and the integration requirements. It also provides an ideal team development problem-solving workshop, one of the most effective organisational development tools in building teamwork. (Harrison, 1991).

In order to provide integration, the planning and control needs to be integrated. Laufer et al (1994) viewed integration as the problem in the planning and control process that needs to be addressed.

This study takes a similar view to Laufer et al's (1994). It emphasises the need to address the issues of how the various participants should be integrated in the process. Integration within the process does not come automatically, as Harrison (1991) appears to suggest. This study proposes that in order to achieve integration in the planning and control process, various key participants need to be involved in decision-making.

### 5.3 The involvement of the key participants in decision-making in the planning and control process of refurbishment projects

The Tavistock Institute (1966) conceptualised the 'socio-technical system' of a production process. This concept is then described and developed further by Trist (1981). Its central principle is that in production organisations, there are both technical systems consisting of machinery and techniques, and social systems of personal and group interaction. The technical systems and social systems are considered as independent variables and need to be integrated to ensure efficient production.

Higgins and Jessop (1965) and the Tavistock Institute (1966) concluded that there is a mismatch between the formal system, shaped by resource controllers and the informal system, shaped by the needs of the technical system.

The mismatch between the formal and informal systems results in a social system of conflicts and mistrust. The Tavistock Institute (1966: p 50) suggested that conflicts and mistrust create 'a culture that produces a climate of endemic crisis which becomes self-perpetuating. The person who can best handle this situation tends to have a crisis type personality. He thrives on this situation and is unwilling to entertain the possibility or validity of any form of planning and control that is not short-term and completely flexible'.

The statements made by the writers above raise the question: 'is there a similar mismatch between the resource controllers (such as site management and contract

management) and the technical system (planning specialists) in decision-making of the planning and control process?' It could be argued that the most serious implication of the lack of co-operation between the formal and informal systems in the building process and the lack of planning would result in inefficient use of resources and unsatisfactory planning performance.

Various authors highlighted the potential for 'mismatch' to occur in the planning and control process. Laufer et al (1994) emphasised that the major issue for the planning and control process of construction projects is that of multiplicity. The issue of multiplicity is concerned with the need for the multiple participants to be involved in decision-making at multiple stages of construction and in the preparation of multiple plans.

Laufer (1992), Laufer and Shapira (1993), Laufer et al (1994) and Shapira et al (1994) discovered that the involvement in the decision-making planning of construction projects varied among various participants. Their degree of involvement depends on the construction project stages, i.e. the pre-bid, pre-construction or construction stage. The various participants involved in decision-making for the planning and control of construction projects identified by Laufer et al (1994) were the project managers, subcontractors, general superintendents, clients, project engineers, design engineers and the home offices. What they found was that there is never a sole planner at any stage in any area. This is due to the fact that part of the information needed for planning and control is held by the various participants. The decisions need to be split among the key participants.

Laufer et al (1994) have also observed a phenomenon which they termed as 'focus-shifting' between two groups of participants. They discovered that during the construction stage, the centre of gravity has apparently shifted from home office to the site, with rising roles for the project manager, general superintendent and project engineer.

The above studies suggest that there are elements of specialisation or differentiation for tasks in the planning and control process. There are reasons to believe that differentiation of tasks would cause a mismatch in the process, in that, different participants tend to concentrate on different aspects of the planning and control process.

It is interesting, therefore, to investigate the extent of differentiation of tasks in the planning and control process of refurbishment projects. The extent of differentiation of tasks in the process is measured in terms of the degree of involvement of the participants in decision-making throughout refurbishment the project's life.

The relative involvement of the key participants in decision-making could also be interpreted as the strength of their political power in the process. Heller et al (1989), however observed that, even today, some management development courses and the related literature avoid talking about power. This, according to him, is probably due to the negative connotations associated with the word. Often, softer substitutes like involvement, participation, autonomy, influence, persuasion and communication or leadership are preferred.

This study hypothesised that the involvement of the key participants in decision-making depends on the refurbishment project stages.

#### **5.4     Research findings on the involvement of the key participants in decision-making at the three refurbishment project stages**

During the semi-structured interview conducted by the author for this study, the following participants were identified to be strongly involved in decision-making in the planning and control process of refurbishment projects. Collectively, they are called the **key participants** in this thesis. The six key participants are:

1. The client: the employer who provides finance and the project brief.
2. The estimator: responsible for build-up unit rates for inclusion in the priced bill.
3. The planning specialist: variously called as planner, construction planner, planning engineer or construction programmer in the construction firms. The planning specialist is responsible for planning the project as a whole or in detail and to translate the plan into programme form.
4. Contract management: includes the contracts manager and the contract director. The contract management is responsible for organising the commencement of work by the programme date, the preparation or assistance of the master programme, finalising the method statement and preparation of expenditure budgets for labour, plant and preliminaries.
5. Site management: includes project manager, site manager and site agent. The site management is responsible for controlling and organising the site work and representative to the main contractor on site.
6. Subcontractors: the employees of the construction firms employed by the main contractor to execute specific works in the refurbishment project. The subcontractors' main responsibilities are to the main contractor.

The relative degree of involvement of the key participants in decision-making at the three refurbishment project stages was established from the analysis of 67 refurbishment projects obtained from the final postal questionnaire survey conducted in this study.

The relative degree of involvement of the key participants was measured on a four-point scales ranging from 1 (not involved), 2 (lowly involved), 3 (moderately involved) and 4 (highly involved). The exact wording and scaling of this measurement are shown in Appendix L.

From the examination of the relative degree of involvement of the key participants in decision-making in the three refurbishment project stages this study will be able to:

1. Identify the 'domain' of the key participants in the planning and control process of refurbishment projects. The domain of the key participants is the stage in which the relative degree of involvement of the key participants is the high. For example, if the planning specialist's involvement in decision-making is high during the pre-bid stage, then the pre-bid stage would then be called the planning specialist's domain.
2. Establish the degree of integration in decision-making of each stage of the refurbishment project. The degree of integration in each stage is measured by obtaining the number of key participants with moderate/high degree of involvement in decision-making.
3. Identify the integrators in the decision-making process of the planning and control of refurbishment projects. An integrator is a key participant with moderate/high degree of involvement in decision-making in all three refurbishment project stages. For example, if a planning specialist has high involvement during the pre-bid, moderate during the pre-construction and moderate involvement during the construction stage, then the planning specialist would be classified as an integrator. Since the integrators' involvement in decision-making is stable throughout the refurbishment project's life, they would show less degree of differentiation in decision-making. In short, their involvement in long-term planning and short-term planning is equally strong.

The mean values of involvement of each key participant in decision-making are shown in table 5.1. They are obtained by using the SPSS Statistical package. The higher the mean values the higher the degree of involvement of the various key participants in decision-making. By using the relative mean values, the pattern of involvement of each

key participant in decision-making throughout the refurbishment is constructed. The patterns of the key participants' involvement are shown in figure 5.2.

**Table 5.1** The relative mean values for the involvement of key participants in decision-making at three refurbishment projects stages

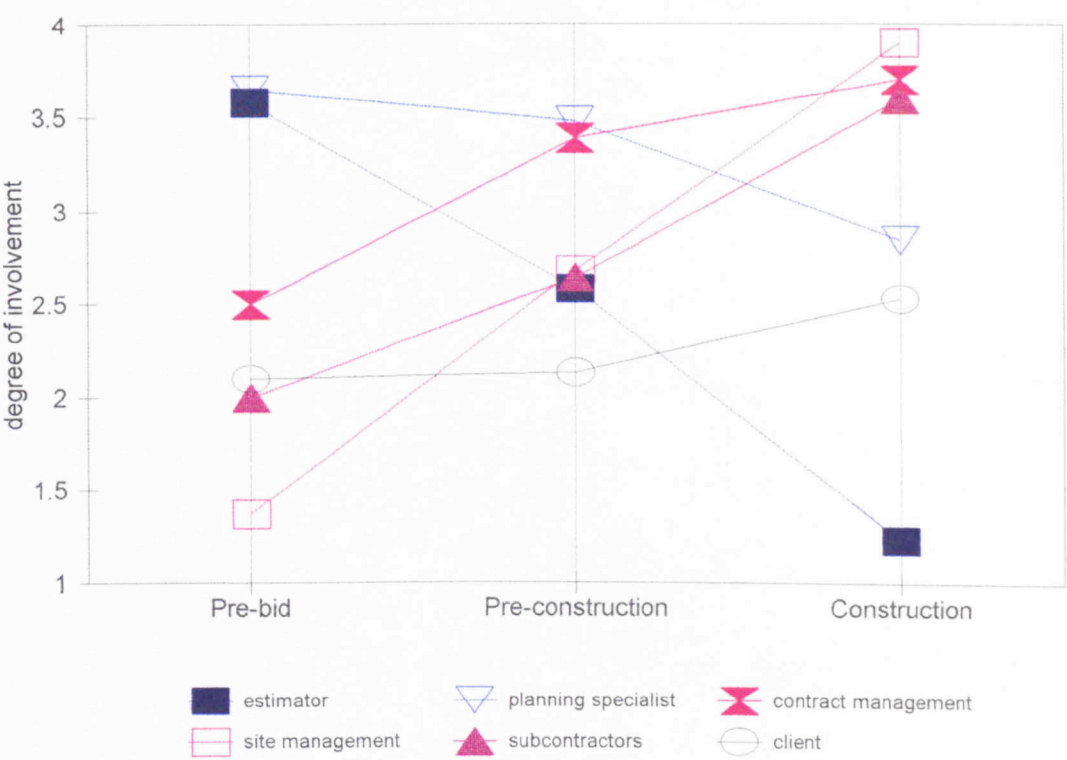
Score: < 1.5 not involved, 1.5 - 2.4 - low involvement

2.5 -3.4 Moderate involvement and > 3.5 high involvement

Key participants	Pre-bid	Pre-construction	During construction
Estimator	3.6	2.6	1.2
Planning specialist	3.7	3.5	2.9
Contract Management	2.5	3.4	3.7
Site management	1.4	2.7	3.9
Subcontractor	2.0	2.6	3.6
Client	2.1	2.1	2.6

Figure 5.2 reveals that the involvement of the key participants in decision-making is varied, depending on the stage of refurbishment project.

Figure 5.2 Relative degree of involvement of the key participants in decision- making at pre-bid, pre-construction and during construction stages of refurbishment projects





During the pre-bid stage, only three key participants i.e. the planning specialist, estimator and contract management are moderately/highly involved in decision-making.

- During the pre-construction stage, in addition to the three key participants, the site management and subcontractors are also moderately/highly involved in decision-making. Only the clients are lowly involved.
- During the construction stage, five key participants are moderately/highly involved in decision-making. Only the estimator is not involved in decision-making during this stage.
- Among the three refurbishment project stages, the degree of integration in decision-making is the least during the pre-bid stage with only half the key participants moderately/highly involved.
- The pre-construction and during construction are equally integrated with five key participants moderately/highly involved in decision-making.
- Only the planning specialist and contract management could be classified as integrators in decision-making. The planning specialist and contract management are called integrators because their involvement in decision-making is moderate/high in all three refurbishment project stages.

The high involvement of planning specialist and the low involvement of site management in pre-bid planning was confirmed during the semi-structured interview conducted by the author with planning and control managers. One planning specialist informed the author that 70% of his responsibility was in the pre-bid and pre-construction stage especially for the preparations for submitting the bid. Once the refurbishment project was secured, the project plans or programmes were then passed to the site management to implement. Although the majority of the planning specialists maintained moderate involvement during the construction stage, it was still left to the

site management to decide whether or not to implement the project programme prepared by the planning specialists. The planning specialists would only increase their involvement when the need arises.

The planning specialist's involvement in decision-making is highest during the pre-bid stage, which is also the planning specialist's domain. During pre-construction stage, the planning specialist's involvement is only slightly lower than during pre-bid stage. The planning specialist's involvement is lowest during the construction stage, at moderate level.

The involvement of the contract management is a mirror image of the planning specialist's. It is stable and constantly within moderate/high level in all three stages. In contrast to the planning specialist's involvement, the contract management involvement increases as the refurbishment project progresses from the pre-bid stage to the construction stage. During the pre-bid stage, the contract management is moderately involved. But during the pre-construction stage, the contract management involvement increased slightly, but still at moderate level. The contracts management is highly involved during construction stage. The construction stage is the contract management's domain.

In contrast to the planning specialist and contract management's involvement, estimator's involvement is less stable ranging from high involvement during the pre-bid stage to not involved during the construction stage. Therefore estimator's involvement in decision-making is more differentiated compared to planning specialist and contract management. The estimator is highly involved during pre-bid stage and is the second most dominant participant, below the planning specialist. Thus the pre-bid stage is the estimator's domain. During the pre-construction stage, the estimator is moderately involved, to become the second lowest among the six key participants. It is sharply reduced further during the construction stage to become the only key participant not involved.

Site management's involvement, on the other hand, is a mirror image of estimator's. Site management is not involved during the pre-bid stage. Site management is moderately involved during the pre-construction stage, almost equal to estimator's. The site management is highly involved during the construction stage, to become the most dominant key participant. The construction stage is the site management domain.

The pattern of subcontractors' involvement is very similar to site management's, but with slightly lower involvement at all three refurbishment project stages. The construction stage is also the subcontractors' domain.

The client has the lowest overall involvement in decision-making in the three project stages. The client's involvement is distinctive in two aspects. Firstly, the client is the only key participant with low degree of involvement in two of the refurbishment project stages, i.e. during pre-bid and pre-construction. And secondly, the client is the only key participant with no high involvement in any of the three refurbishment project stages. The client's involvement is therefore unique. The client is the only key participants without a domain.

Young et al's (1996) study, acknowledged earlier, found that there was a greater degree of involvement of the client in ship refurbishment work than in construction. When members of the contractors' teams from both industries were asked the extent to which they were satisfied with the involvement of clients' representatives in the refurbishment projects, 92.3% respondents from the ship refurbishment sector indicated that they were either satisfied or very satisfied as compared to 36.4% of respondents from the construction refurbishment sector.

Although interviewees from the construction refurbishment sector all accept that there are benefits from greater involvement by the client in the works, most of them also suggest that greater involvement of clients, to some extent, can stifle the regular progress of the works. Most importantly, many of them are of the view that this could jeopardised their profit margins.

Young et al (1996) argued that the relatively higher degree of involvement shown by the ship refurbishment clients in the management of refurbishment works is a reflection of the fact that for most ship refurbishment clients, the ship itself is a substantial part of their business 'empire'. For most construction clients, the building, as a shell, is only a very small proportion of their businesses. Young et al (1996) concluded that there are better informed clients in the ship refurbishment sector than there are in the construction refurbishment sector. The ship refurbishment clients appear to be more knowledgeable about refurbishment processes, and what they expect as the final product from refurbishment.

The above results reveal that there is differentiation of tasks in the planning and control of refurbishment projects. Different key participants dominate each stage of decision-making. The pre-bid stage is dominated by the estimator and planning specialist. The pre-construction stage is dominated by planning specialist and contract management. Whereas the construction stage is dominated by the site management, contract management and subcontractors. All key participants, except the client, have their own 'decision-making domain'. In the case of planning specialist and estimator, their domain is the pre-bid stage. In the case of contract management, site management and subcontractors, their domain is the construction stage.

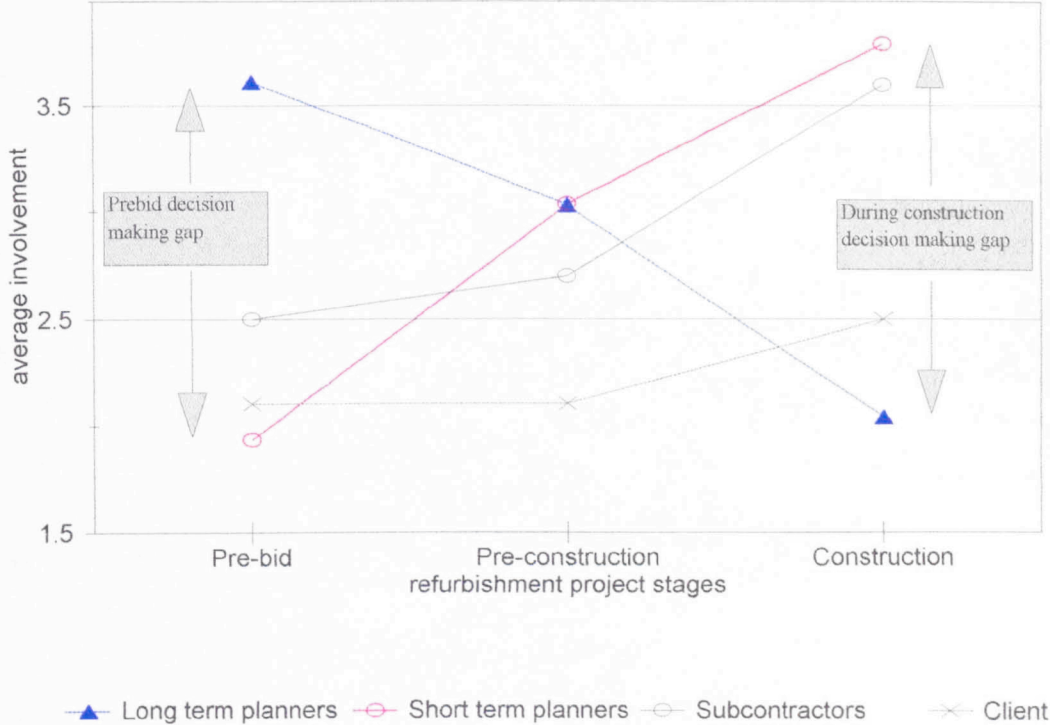
These results are almost similar to those found Laufer et al (1994) also discovered that the involvement of various participants in decision-making are also varied. For example:

- The home office is strongly involved in pre-bid planing and very little during pre-construction and construction.
- The project engineer is almost completely uninvolved during the first pre-bid and pre-construction but strongly involved during construction.

- The subcontractors are highly involved in pre-construction planning and planning during construction but not during pre-bid.
- The project manager is involved in more planning areas throughout the project's life than any other functionaries.

Even though it has been argued that planning and control is an integrated process, the separation of refurbishment project into 3 distinct stages appears to divide the key participants into 2 distinct groups as shown in figure 5.3. There appears to be a distinct pattern of involvement, with planning specialist and estimator on one hand, and contract management, site management and subcontractors on the other. In the case of estimator and planning specialist, their major tasks appear to be in long-term planning, which is associated with strategic decision-making. In this thesis, they are called long-term planners. Whereas, in the case of contract management, site management and subcontractors, their major tasks are in short-term planning which is associated with tactical decision-making. They are called here short-term planners. The patterns of involvement of the long-term planners and short-term planners are illustrated in figure 5.3.

Figure 5.3 The decision making gaps in the planning and control process of refurbishment projects



From figure 5.3, it could be seen that there are 'decision-making gaps' between the long-term planners and the short-term planners at all three stages of refurbishment projects. Different key participants dominate each stage. The involvement of key participants in decision-making produced an 'X' pattern of involvement. The gaps show the differentiation of tasks between the long-term planners and the short-term planners.

It is likely that the decision-making gaps make it more difficult to provide integration in the planning and control process. Few would disagree that ideally the tasks of long-term planning and short-term planning should be carried out by the same people. Looking from a different angle, it could be proposed that the key participants, who are involved in decision-making during the pre-bid stage, should also be involved during the construction stage. This implies that their level of involvement in decision-making at both stages must be equal. The pattern of involvement should be in the shape of '=' instead of 'X'. This would ensure the continuity of information flow.

It is interesting to examine why the 'X' pattern prevails. The factors that caused decision-making gaps will be discussed here. The discussion will then proceed to the implications of the decision-making gaps.

The review of literature suggested that the following factors are the cause of the decision-making gaps or differentiation: -

- a) The high degree of specialisation of tasks.
- b) The contractual system.
- c) The shortage of time of project and site management to plan.
- d) The lack of knowledge, training and experience of site management in planning techniques.

McGowan et al (1993) pointed out in small building projects, with a lesser degree of task differentiation, planning and control tasks among the key participants overlap. This situation is linked to unclear definition of responsibility and greater tendency for

conflicts to occur within the construction project organisations. The differentiation of tasks avoids this conflict. The examination of the organisational charts obtained in the preliminary postal questionnaire survey revealed that two construction firms even went further by specialising contracts managers into pre-bid contracts managers and post-bid contracts managers.

Hillebrandt (1974) and O'Brien (1984) maintained that fixed-price construction projects gave rise to contracting uncertainty. The traditional procurement system hindered early planning during the engineering design and pre-bid stage, because of economic considerations and low rate of bid success. Hence, the pre-bid planning is left to planning specialists.

Since contractors have little control over the pace and timings at which bids are issued, and less still over awards of contracts, it is very difficult to pull out a project manager from an active project and to assign him immediately to a new one. Even when this is possible, the short interval, until the required mobilisation date stipulated by the owner, leaves the project manager with no time for preparatory planning. He must turn his attention immediately to putting a new organisation together (Stukhart et al, 1986).

Syal et al (1992) observed that in many construction projects, a working project manager or site manager simply does not have the time to formally replan the project whenever changes in construction occur. As a result in most small size firms and even in some moderate size construction firms, the construction project planning decisions are often made in ad hoc fashion and as the problems arise. The planning task is performed by a combined effort of a cost estimator, whose primary concern is the 'final number' and engineer or an outside consultant, whose primary responsibility is to 'put together' a construction schedule. Laufer and Tucker (1988) pointed out that shortage of time of construction managers and especially of project managers is not limited to projects in progress, but applies equally to the interval prior to commencement of projects.



In order to overcome the problem of shortage of time and lack of technical expertise of the construction and site management, the majority of large construction firms employed planning specialists, or set up a separate planning department that effectively took the responsibility for any replanning from the hands of site management. Consequently, differentiation between planning specialist and the contract management and site management (line managers) are created with the planning specialists tending to concentrate on long-term planning and the line managers tend to concentrate on short-term planning.

Besides, some construction managers are also reluctant to be involved in planning, as they dislike having to commit themselves and display their plans or lack of them to senior management (Harrison, 1991). Hence, long-term planning is left to the planning specialists.

Harrison (1991) maintained that even if a construction or a site manager has of plenty time and the motivation to do so, his involvement could still be hampered if his knowledge in planning techniques is lacking. Laufer (1994) highlighted that much time for planning is required for documentation and the preparations of plans (in the forms of tables, charts and diagrams), as well their dissemination and communication. The presentation of decisions into plans requires special training, technical skill and experience in the use of tools (e.g. computer) and planning techniques. The construction and site managers who have little experience and knowledge of the techniques of such planning may find it difficult to think systematically and anticipate events especially in complex and uncertain projects.

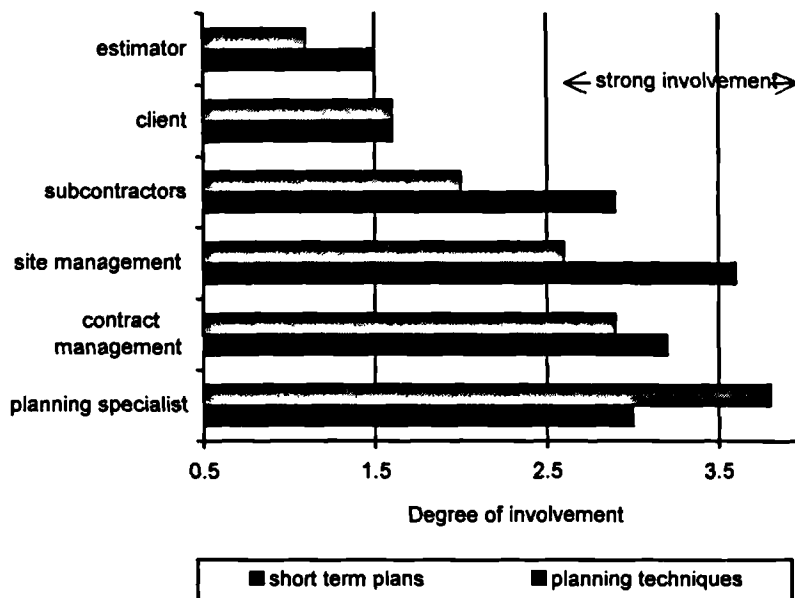
The level of skills and knowledge of the key participants in planning techniques is reflected in their level of involvement in the preparation of the planning techniques. In order to determine whether the level of skills and knowledge of the key participants in planning techniques are the reasons for the decision-making gaps, this study asked the respondents in the final postal questionnaire survey to indicate the level of involvement of the key participants in the preparation of four major plans, i.e. the planning

techniques, short-term plans, method statement and site layout. The degree of involvement of the key participants was recorded on a four-point scale ranging from 1, not involved to 4 highly involved. The exact wording and scale are shown in Appendix L. The results are shown in figures 5.4 and 5.5.

Figure 5.4 shows that even though it is evident that the planning specialist dominates the preparation of planning techniques, the involvement of the line managers, i.e. the site management and contract management are equally strong. Most certainly the high level of contract management and site management in the preparation of planning techniques enable the refurbishment project organisations to distribute the responsibility of the preparation of planning techniques among the key participants. This also enables the planning specialist to concentrate during the pre-bid and planning and control stage and site management and contract management during the construction stage.

All planning and control managers interviewed in this study also maintained that contract management and site management have a high degree of skills and knowledge of planning techniques and require little assistance from the planning specialist. In large and complex projects however, it is the shortage of time, rather than the lack of skills and knowledge of the line managers that necessitates the greater involvement of the planning specialist in the preparation of the planning techniques. The fact that in most refurbishment projects the bar charts instead of more sophisticated planning techniques are used explains why the responsibility could be distributed almost evenly among the three key participants.

Figure 5.4 The relative degree of involvement of the key participants in the preparation of planning techniques and short-term plans



This involvement of the key participants in the preparation of short-term plans was also investigated. The short-term plans encompass all programming and planning procedures undertaken during the construction stage, when the construction work progressed on site. These include the preparation of stage programmes every four to six weeks. The stage programmes enable the master programme to be broken down into greater detail and more manageable proportions and takes into account current resources and information available from the architect and the consulting engineer.

Weekly planning by the site foreman enables the requirements of the stage programming to be analysed into further detail. This directly involves site management in decision-making. The preparations of weekly plans are normally carried out simultaneously with the revision of master programmes. This is done in order to keep the master programme under constant review and responsive in the light of changing and unforeseen circumstances. New requirements that necessitate changes

to be made to the master programme are highlighted in the preparation of short-term plans. The integration of the two processes, the revision of master programme and the preparation of short-term plans help the site management to be aware of the factors affecting the utilisation of labour, materials and plant and the effects on completion date for each stage of work. It also enables subcontractors and suppliers to be closely integrated into the planning process.

Figure 5.4 also provides little evidence to suggest that there is a tendency for planning specialist to concentrate on long-term planning. Even though it is clear that the site management and contract management dominate the preparation of short-term plans, the involvement of the planning specialist is also strong. This reflects the high emphasis being placed on the integration of long-term planning and short-term planning for the refurbishment project organisations.

The method statement and the site layout are two other plans, which are widely used in construction projects. Cooke (1993) informs us that where organisations use a centralised head office, the regional office may be responsible for the preparation of the method statement for enquiries within its own region. The regional contracts manager will prepare the method statement and assessment for contract preliminaries and submit these to the chief estimator for discussion at the main tender meeting. The planning department is always consulted on method statements.

When methods of construction have been agreed, the job estimator is responsible for interpreting the methods into realistic bill rates. The methods used by the estimator to prepare bids during the pre-bid stage could be changed, but normally fall within the budgeted costs. After the pre-bid stage, the involvement of the estimator in the preparation of all plans reduces sharply.

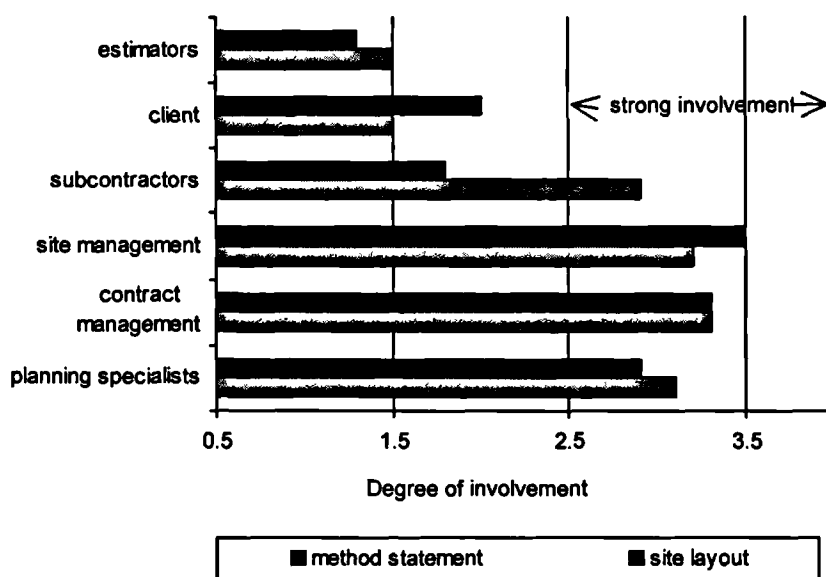
The method statement is also used by the key participants to explore alternatives during the pre-construction stage. Therefore, the construction methods allowed for in the estimate must be flexible enough to enable reconsideration at the pre-contract

planning stage as more detailed information becomes available. It is also used as a guide for the site management for planning and control, for example, as the basis for requisitioning plant and forecasting the labour force needed. The involvement of estimator is still vital.

The site layout plans are mainly concerned with the efficiency of movement on the construction project site. Among the major decisions taken in the preparation of site layout is the provision of adequate access roads, location of major plant and areas for storage of materials. Cormican (1985) observed that the planning specialist and/or contracts manager would prepare schemes and discuss them with clients.

Figure 5.5 Shows that the planning specialist, contract management and site management are strongly involved in the preparation of these two plans. The involvement of the estimator is again found to be low.

Figure 5.5 The relative degree of involvement of the key participants in the preparation of method statement and site layout



The most distinctive feature of the involvement of the key participants in the preparation of all four plans is that estimator is almost entirely excluded.

It could be argued that there are benefits of integrating estimator in the preparation of plans. In an uncertain construction project where changes are endemic, the success of the projects is determined by the degree of integration of the key participants with different skills involved in the planning and control process. The estimator who holds vital cost-information could contribute significantly to monitoring cost and time variance.

The low involvement of the estimators in the preparation of planning techniques and short-term plans could be attributed to their lack of skills and knowledge which implies the need for training for estimators in these areas.

A more plausible explanation of the low involvement of the estimator in the preparation of plans is because of a deliberate strategy on the part of construction firms. In most construction firms, the estimator is mainly responsible for the build-up of the unit rates for inclusion in the priced bill. This also involves obtaining materials and subcontractors quotations. Often the estimator has to bid for many projects simultaneously. Shortage of time hinders many estimators to be actively involved during the construction stage.

Hence, it could be concluded that the skills and knowledge of the key participants in the preparation of plans is not a major factor that contributes to the decision-making gaps. Most likely that the pressure and uncertainty of obtaining contracts compel the construction firms to differentiate the tasks of the key participants in decision-making. The need to avoid conflict and the lack of time of the key participants in the preparation of plans may widen the decision-making gaps but most probably only to a small extent.

## 5.5 The implications of the decision-making gaps

There are three major implications of the decision-making gaps: -

- Communication and information flow.
- Differences in attitudes.
- Power and conflicts.

The major implications are discussed in turn below.

### 5.5.1 Communication and flow of information

It could be argued that the more differentiation of activities and specialisation of the labour force, the more difficult the problems of co-ordination and communication would be. McGowen et al (1983) pointed out that differentiation introduced both a time lag and a boundary through which information must flow. This view is supported by Koontz and O'Donnel (1972) who described this boundary as the 'planning gap'. The gap occurred due to the difficulties of furnishing adequate information and because managers do not understand the importance of planning and control communication.

A planning specialist, whose main function is long-term planning, needs data to plan. The planning specialist activities include the employment of formal and informal data collection methods both of internal and external origin. Most certainly, the earlier in the life of a project the planning specialist comes to grip with all the relevant functional areas, the greater his influence upon the projects. Le Preton and Henning (1961: pp 342), however, observed that planning specialist's position as a staff personnel with no command authority hindered his ability to receive complete and speedy information. Some of this external information is privileged and comes from sources inaccessible to the planning specialist. This includes information from the clients' management and from top management of the construction firm itself, which is predominantly

transferred through face-to-face interaction with construction or site managers. To compound the problem for the planning specialist, the information needs to be regularly updated and typically affects the goals and constraints on which the execution plans are founded. Furthermore, the planning specialist who collected information through indirect means only rarely encounters on-site execution problems. The line managers (for instance, contract management, site management and subcontractors) have to share the privileged information with the planning specialist. The line managers, by virtue of their role as implementers, have an additional advantage - information accumulated through personal experience.

Laufer and Tucker (1988) suggested that line managers, should co-operate with staff planners (such as planning specialist and estimator) in planning. The nature of their co-operation is mainly determined by their respective functional area of planning and the state of the project.

Laufer (1992a) concluded that separation of line managers who hold the formal authority from staff planners who possess the technical expertise in project planning is untenable and artificial. They have to share in the decision-making power. The line manager is unable to carry out planning alone, and he must be assisted by staff who possess one important commodity - enough free time. The line manager must co-operate in planning, and not leave the tasks of long-term planning to staff planners.

The ability of the line managers to co-operate with planning specialist is however hindered by the difficulties in transmitting planning and control information to planning specialist. The information, available to the line managers is often unstructured and not documented and is only transmitted orally to various planning and control managers. Furthermore, the information is required to be up-to-date and is often given at short notice. The problem of uncertainty faced by the line managers is invariably passed to the planning specialist.



### 5.5.2 Differences in attitudes

The difference in training and functions between line manager and the staff planner created a fundamental difference in their decision-making attitudes. According to Laufer and Tucker (1988) the planning specialist's orientation is long-range, inducing the planning specialist to integrate future project activities with systematic data gathering and analysis, whereas the line manager's orientation is typically short-range. Line managers plan incrementally, primarily employing recent ad-hoc information. Some writers go to the extreme of maintaining that conditioning of managers makes it difficult for them to deal in abstractions. They are far more at home with managing routine operations than with thinking systematically about the future (Badawy, 1982; Harrison, 1981; Hollins, 1971; Mintzberg, 1973 and Morton, 1983). Arditi (1981) observed that while planning specialists proudly see frequent updating as one of their primary tasks, site management finds it difficult to live with real-life situations.

Galbraith (1977) observed that the high levels of task uncertainty differentially affect sub-tasks and, therefore, affects the relationship between team members. The effects occur partly through the differences in attitude or orientation associated with differentiation, and partly through differences in the power of individuals or groups that task uncertainty gives rise to.

It could also be argued that the differences in attitude or orientation of the key participants in planning and control of refurbishment projects could be reduced if they were integrated throughout the refurbishment project stages. There would be less tendency for conflicts to occur since the key participants would accept the plans more readily. The involvement of site management during the pre-bid stage and of estimator during the construction stage would reduce the conflicts between the long-term and short-term needs of refurbishment projects.

### 5.5.3 Power and conflicts

Harrison (1992) observed that the approach of employing planning specialists is not sufficient to ensure planning and control effectiveness. Although in themselves they may be effective, it is not possible merely to graft on formal planning to an organisation. Moreover, the fact that scheduling is prepared by others, contributes to the line manager's perception that the system exists to track and record their failings (Gilkeson, 1981 and Morton, 1983).

It could not be dismissed that the actual pursuit of planning objectives is affected by the users' planning needs and their relative political power. The line managers, being the implementers, tend to have greater political power and tend to make greater decisions in the planning and control process during the construction stage. Decisions made by others are less likely to be welcome.

In complex and uncertain situations, however, the political power may tend be redistributed. Some of the power would be shifted to the planning specialists who possessed vital knowledge and skill in the handling of uncertainty. Crozier (1964) has argued that the control of uncertainty, within an otherwise routinised situation, confers power.

The shift of balance of power is more likely to be resented by the by the line managers. Indeed, in the project environment, line managers who presumably accept the planning specialists as an aid to decision-making, actually perceive them as a potential threat that constitutes a competing power-base within the organisation (Morton, 1983).

Nutt (1976) who investigated the decision-making conflict between authority based on the power of office and authority based on technical knowledge concluded that it is possible to use staff specialists for decision-making only when the decision is largely

routine or predictable. But uncertainty creates dependency on those people, roles or units that can overcome problems stemming from lack of predictability. Turbulence in the environment also creates some uncertainty but, up to a certain degree, it seems to be associated with a reduced power concentration or more participative decision-making (Lorsch and Morse, 1974 and Rus et al, 1977).

Therefore, it could be concluded that construction firms are facing a dilemma in the planning and control process. The construction firms employ planning specialists (or long-term planners) in order to help the contract management and site management (or short-term planners) to plan, so that the project organisation would be better able to cope with the project environment. On the other hand, the presence of planning specialists results in differentiation within the project organisation.

Thus differentiation of tasks could have serious implications for the effectiveness of the planning and control process of refurbishment projects. The higher the degree of differentiation the higher the need for integration. Higher integration could be facilitated by project groups and teams, effective formal channels of communication and through reliable and accessible information to staff about their jobs and firm (March and Simon, 1958; Burns and Stalker, 1961; Lawrence and Lorsch, 1968; Galbraith, 1973; Winch, 1989; Morris, 1973 and 1983; Walker, 1984 and Reuschmeyer 1986). One way of providing effective channels of communication is by integrating (or involving) the key participants in the decision-making (Walker, 1986 and Galbraith, 1977).

## 5.6 Integration

Laufer (1996) said, that the challenge of managing complex projects with interdependent disciplines, is to ensure integration and teamwork between different participants and make the team perform as a unified entity.

The requirements of the environment and technical system are often determined by the degree of co-ordination required. Laufer and Cohenca (1987) observed that since higher uncertainty demands more frequent updating, it is necessary to shorten the communication time between the source of information (site), the locus of decision-making (head office) and the implementation area (again site).

The review of literature reveals that there are three methods listed below to achieve integration in construction projects.

- a) Integrators
- b) Horizontal integration
- c) Vertical integration

#### 5.6.1 Integrators

Lawrence and Lorsch (1967) observed that there is a tendency to formalise and co-ordinate activities that have developed informally and voluntarily. For example, specific individuals are assigned the role of integrator.

In most successful organisations, the influence of the integrators stemmed from their professional competence rather than from their formal position. They are successful as integrators not only because of their specialised knowledge but also because they represented a central source of information.

During the semi-structured interview on the planning and control of refurbishment projects conducted by the author, it was found that continuity of information flow in refurbishment projects appeared to be partly provided by the presence of two integrators, i.e. the planning specialist and the contract management. During the construction stage, for example, the site management and subcontractors could get part of the information collected and decisions made by the estimator, either from planning specialist or

contract management. Thus the planning specialist and the contract management are at the centre of the project information.

The results from the analysis of the final postal questionnaire survey also shows that the planning specialist and contract management appear to play the role of integrators.

#### 5.6.2 Vertical integration

Various authors argued that vertical integration could be achieved when functions are performed physically in one organisational boundary under common leadership (Nam and Tatum 1992: p. 389). There is, however, an increasing tendency toward some vertical integration, such as architect-engineer design firms and design-build firms, especially in the larger corporations specialising in industrial construction (Cassmatis, 1969 and Rossow and Moavenzadeh, 1974). The major advantages of the design and build approach are close co-operation between design and production from start to finish and the possibility of using fast-track construction methods. Also, from a design and build firm's point of view, learning can be accumulated rapidly. Arguments against such vertically integrated firms include the contractors limited ability in putting together a design-production team. Many construction firms employ external designers on a contractual basis. The designers are therefore not fully integrated into the construction firms.

It has been established in chapter 4 that the design and build refurbishment projects had higher planning performance, albeit insignificantly. It is suggested that more study should be conducted in this area.

### 5.6.3 Horizontal integration

Most organisation charts are drawn to emphasis the vertical hierarchy and show superior-subordinate relationships. Very few of the organisation charts indicate horizontal interaction of those integrative activities that flow between departments, units or individuals at approximately the same level (Hall, 1972).

Horizontal relationships are those functions that are not primarily the passing down of orders or the passing up of information because one actor is superior to the other in the organisation's hierarchy. The function of horizontal relationships is to facilitate the solution of problems arising from the division of labour. The nature and characteristics of horizontal relationships are determined by the participants having different organisational subgoals but interdependent activities that need to intermesh (Landsberger, 1961: p.300). The modern organisation depends on lateral relationships precisely because there are so many specialised points of view and so many that require contacts that no single manager can handle the communication flow alone (Sayles, 1966).

Various writers on planning and control concurred that for efficient execution of a project, integration of decisions and wide involvement of key groups in the process are necessary (Bennett, 1992; Walker, 1989; Ackoff, 1970; Laufer et al, 1994; Koontz and O'Donell, 1972 and Harrison, 1992). Ackoff (1970) noted that 'the principal complexity in planning derives from the interrelatedness of decisions rather than from the decisions themselves'. Laufer (1994) maintained that since construction planning is an iterative and interactive process performed at different organisational levels and at different times and locations, securing planning integration is a crucial task.

The difficulties of proper understanding of decisions made by others are found to be a prime obstacle in implementing. This creates abstractions that are difficult to communicate (Trull, 1966 and Le Breton and Henning, 1961).

In the planning and control process, it is impossible to review and approve hundreds of interrelated decisions if one has not been involved in their preparation. The greater the involvement of the implementer (contract and site management) in the decision-making process, the greater the prospect for the successful implementation of the plans.

The horizontal integration of contributors within and between the planning and control tasks is important. Development and evaluation of alternatives needs the greatest interaction between the estimator and the planning specialist on the one hand and contract management, site management and subcontractors on the other. Even though the planning specialist and estimator do most of the long-term planning, it must be executed under the close co-operation of the contract management, site management and subcontractors.

Walker (1989: pp 96) proposed that integration could be achieved by involving the people with the right skills at the right time in decision-making. Most certainly, in order to stand the best chance of making the correct decision, the range of available alternatives and supporting arguments will have to be presented in each case.

Walker's proposition raises two pertinent questions in the this study: -

- Who are the right people to be involved at each stage of refurbishment project ?
- Should their involvement be adjusted to suit the different levels of complexity and uncertainty of refurbishment projects?

The arguments presented by the various writers implied that it is important to involve the key participants, whose main activities are in short-term planning, in the long-term planning, and vice-versa. In other words, it is important for contract management, site management and subcontractors to be integrated in the planning specialist' and estimator's domain. To put it differently, it is important to involve of contract

management, site management and subcontractor during the pre-bid stage and to involve the planning specialist and estimator during the construction stage.

The main concern here is to what extent should the long-term planners be involved in short-term planning and short-term planners in long-term planning? It is important to ensure that their roles are properly defined in order not to cause conflicts. The need to reduce conflicts and to maintain control in the process provides strong justification for differentiation.

During the semi-structured interview conducted by the author, however, two planning and control managers argued that greater involvement of site management during the pre-bid stage in order to provide greater horizontal integration is not always practical. Integration could still be achieved by ensuring that all the key participants involved in decision-making interact during the pre-construction stage. In short, the pre-construction stage is treated as an integrative stage. According to the planning and control managers, this is implemented in order to use resources more efficiently.

The results from the final postal questionnaire survey appear to support this argument. Figure 5.2 reveals that during pre-construction, five key participants are integrated in the decision-making of refurbishment projects. The pre-construction stage is distinctive because it appears to become a meeting point for two groups of key participants. The two groups are the long-term planners (i.e. the planning specialist and estimator) and the short-term planners (i.e. the contract management, site management and subcontractors). The pre-construction stage, therefore appears to function as a 'hand over' stage when information collected by the estimator is transmitted to site management and subcontractors. After the pre-construction stage the estimator left the scene altogether.

Thus the benefits of greater involvement of short-term planners in decision-making during the pre-bid stage and long-term planners during the construction stage are not totally clear. This study hypothesised that the higher involvement of the key participants



outside their domains, the higher the planning performance. This hypothesis will be tested in section 5.7.

### 5.7 The involvement of key participants in decision-making and refurbishment planning performance

Laufer and Cohenca (1988) said that the ultimate test of a decision is whether the decision-maker can impel others to implement it. The extent and manner in which the implementers are involved in the decision-making process materially affects the success of implementation. This has been substantiated in the case of low-level workers performing routine tasks (e.g., Jenkins and Lawler, 1981), and applies even more significantly to managers in charge of complex operations. Bass and Leavitt (1963) showed that performance and attitudes were better when subjects were using plans developed by themselves rather than by others.

Bresnan (1988) maintained that the levels of task complexity and uncertainty, coupled with the levels of interdependence between subtasks, have been taken as the independent variables, which influence the design of organisations. The design of the organisation takes into consideration the allocation of tasks among the key participants. If the organisations do not consciously choose to co-ordinate the involvement of the key participants in decision-making, reduced performance standards will happen automatically.

Laufer (1996) argued the need for multi-phased integration, i.e. the leader of the next phases of the project need to be involved in planning from the earliest possible moment and in all subsequent phases. Multiphased integration is facilitated when the contract is a long-term commitment of the partners. Multiphased integration helps to improve communication flow and feedback systems. The involvement of implementers in upstream decisions would certainly improve the quality of downstream decisions. The product would be greater teamwork and job satisfaction.

This implies that short-term planners should be integrated during the pre-bid stage and long-term planners be integrated during the construction stage in order to improve planning performance. The main hypothesis to be tested here is that the higher the involvement of the key participants in decision-making the higher the planning performance. It is of particular interest to establish whether multiphased integration, indicated by higher involvement of the key participants outside their domain, would increase planning performance.

Human relations theory made the simple assumptions that there is a causal chain from involvement in decision-making to increased satisfaction. Increased satisfaction, in turn leads to a greater acceptance of authority and consequently improved performance in decision-making (Heller et al, 1989). Performance in decision-making is measured in terms of the extent to which desired outcomes have been achieved. Miles (1965) explains the contrast and the advantages of the human resources model, which has as its primary aim to use people's real capacities by involving them in decision-making and in this way seek to improve the quality of work and decision-making.

Heller et al (1989) found that skill under utilisation is a function of low involvement in the decision process. To make better use of existing experience and competence, decision-making practices have to allow key participants to exert influence. However, there is no conclusive evidence that skill under utilisation is the main reason for low planning performance in refurbishment projects. Firstly, studies on skills in the construction domain are mostly concentrated on the identification and development of skills and not on their utilisation. Secondly, possibly as a result of this neglect, it has proved difficult to demonstrate the presence of non-activated skills in construction projects.

Maslow's self-actualisation theory of human behaviour can be extended to argue that participative behaviours favours self-actualisation and this in turn allows untapped reservoirs of human production resources to be used. Likert (1967) in particular was

convinced of the value of motivation and that, the creative abilities of employees and their involvement, were important as financial rewards as a motivating factor. Arguably, when the employees are motivated, they will work to the best of their ability, enthusiastically and intelligently and in turn, may increase planning performance.

Positive associations between involvement and effectiveness in decision-making have been found in several studies (Likert, 1967; Tannebaum, 1968; Kavcic et al, 1971; Argyris 1972; Pennings, 1976; Dickson, 1981 and Miles, 1965) but not in others (Filley et al, 1976 and Locke and Schweiger, 1979).

The degree of involvement of the key participants in decision-making reflects their efforts. Increased involvement of the key participants in decision-making requires both time and financial resources. Due to this, the degree of involvement of the key participants in decision-making at each stage of refurbishment projects needs to be rationalised to ensure efficient use of resources.

Faniran et al (1994) in their study titled 'Effective construction planning' analysed the planning performance of 26 construction projects of different types and sizes. They discovered that a number planning performance variables are significantly affected by planning efforts. One of the major findings in Faniran et al's (1994) study was that increased planning time reduced cost variance and time variance.

The associations between the involvement of the key participants in decision-making at the three refurbishment projects stages, and planning performance, were sought in this study. The independent variables are the involvement of the key participants in decision-making which include estimator, planning specialist (long-term planners), contract management, site management and subcontractors (short-term planners).

The dependent variables are the planning performance variables, which include cost variance, time variance, quality of workmanship and the extent of planning techniques used for monitoring during the construction stage.

The Spearman's correlation technique was carried out to establish the associations between the involvement of the key participants and planning performance. The results are shown in tables 5.2, 5.3 and 5.4. **Negative correlations** were expected between the independent and dependent variables.

### 5.7.1 Research findings

Table 5.2 The associations between the involvement of key participants in decision-making during pre-bid stage and planning performance

Key participants	Cost variance	Time variance	Quality of work- manship	Extent of monitoring♣
Clients	.08	-.13	-.02	-.03
Contracts management	-.04	-.05	-.04	-.26*
Estimator	-.27*	.08	-.05	-.12
Planning specialist	.07	-.07	-.21	-.30*
site management	.07	.06	-.01	-.21
Subcontractors	.04	-.09	-.03	-.14

\* 0.05 significant level    \*\* 0.01 significant level

♣ The extent to which the planning techniques were used for monitoring during construction

Table 5.3 The associations between the degree of involvement of key participants in decision-making during the pre-construction stage and planning performance

Key participants	Cost variance	Time variance	Quality of workmanship	Extent of monitoring ♣
Clients	-.11	-.18	-.01	.07
Contracts management	-.06	.11	.07	.00
Estimator	-.43**	-.14	.03	-.18
Planning specialist	-.22	-.06	-.13	-.19
Site management	.25	-.22	.12	-.38*
Subcontractor	.24	.05	-.08	-.16

\* 0.05 significant level    \*\* 0.01 significant level

♣ The extent to which the planning techniques were used for monitoring during construction.

Table 5.4 The associations between the degree of involvement of key participants in decision-making during the construction and planning performance

Key participants	Cost variance	Time variance	Quality of workmanship	Extent of monitoring ♣
Clients	-.06	-.16	-.11	-.02
Contracts management	-.04	.08	-.07	-.23
Estimator	-.29*	-.07	-.03	-.19
Planning specialist	-.09	.04	-.14	-.38**
Site management	.07	-.07	-.13	-.13
Subcontractors	.02	-.01	-.11	-.07

\* 0.05 significant level    \*\* 0.01 significant level

♣ The extent to which the planning techniques were used for monitoring during construction.

Tables 5.2, 5.3 and 5.4 reveal that the correlation values are mostly negative which supports the hypothesis that a higher involvement of the key participants in decision-making is associated with a higher planning performance. However, only five of them are significant, three are related to cost variance and another two to the extent to which the planning techniques are used for monitoring.

The few significant correlations between the degree of involvement of the key participants in decision-making and the level of planning performance provide, a valid reason for specialisation in the planning and control of refurbishment projects. There is

insufficient evidence to suggest that the site management and subcontractors should be highly involved outside their domain.

However, the following results provide strong arguments for greater integration in the planning and control process :-

- The higher the involvement of estimator during the construction stage, the lower the cost variance.
- The higher the involvement of planning specialist during the construction stage, the greater the extent to which the planning techniques were used for monitoring.
- The higher the involvement of contract management during the pre-bid stage, the greater the extent to which the planning techniques were used for monitoring.

The significant correlation between the involvement of the estimator in decision-making during the construction stage and cost variance is of a considerable interest here for two reasons: -

- The cost variance is a major problem in refurbishment projects.
- The estimator is the only key participant who is not integrated during the construction stage.

There is a strong argument for increased involvement of the estimator during construction stage. Cost information is not only complex in nature but also highly sensitive. It also tends to fluctuate throughout the construction stage as new and additional cost information is obtained. The flow of information relating to cost would be impaired if the estimator, who is the most knowledgeable about project cost is excluded.

Ackoff (1970) argued that planning should not be separated from implementing. The significant association between the involvement of contracts management in pre-bid and the extent to which the planning techniques were used for monitoring, supports this

argument. Plans are more likely to be implemented if the implementers involved from the early stage of decision-making.

The planning specialist is the dominant participant in the preparation of planning techniques. There is a greater chance that his planning techniques will not be implemented if he is not involved during construction stage. The site management will be less inclined to implement the planning techniques prepared by others. The involvement of the planning specialist during the construction will create a better understanding between the planning specialist and the site management. This will encourage the site management to implement the planning techniques prepared by the planning specialist.

It could be proposed that increased project complexity and uncertainty require increased involvement of the key participants outside their domain. The validity of this proposition is tested by the Spearman's correlation technique. The results are shown in appendices O, P, Q .

The results show some evidence that the involvement of the key participants needs to be adjusted, depending on the situations. The important findings are listed below: -

- The less complete the design before work commences on site, the higher the involvement of site manager during pre-bid stage.
- The higher the percentage of services relative to contract value, the higher the involvement of subcontractors during pre-bid stage.
- The higher the number of subcontractors employed in the refurbishment projects, the higher the involvement of planning specialists during construction stage.
- The less complete the design before work commences on site, the higher the involvement of planning specialist during construction stage.

Since there are only four significant correlations, it could be concluded that, in the main, the key participants tend to remain in their domain, disregarding the level of complexity

and uncertainty of the refurbishment projects. However, under a few instances they tend to venture outside their domain.

The significant correlation between the percentage of services relative to project contract value and the degree of involvement of subcontractors is expected since the majority of services work are carried out by the subcontractors. The higher involvement of subcontractors may help the contractors to produce more competitive bids.

Few would disagree that the knowledge and experience of site management is useful to interpret incomplete design information during the pre-bid stage. The estimator and the planning specialist most likely to need the advice of the site management during the pre-bid stage when design information is not complete.

Increased involvement of the planning specialist during the construction stage would provide greater co-ordination. The planning techniques could be produced in greater detail and deviations in the progress of the project could be detected more easily. This is especially beneficial when the refurbishment projects employ a large number of subcontractors. When the design information is incomplete, the planning techniques need to be revised more frequently during construction. Increased involvement of the planning specialist during construction could help to reduce the workload of the site management.

Obviously more research needs to be carried out in greater detail on how the involvement of the key participants in decision-making should be modified to suit varying degrees of complexity and uncertainty of refurbishment projects. Research in this area will be useful to establish how a greater flexibility could be achieved in the planning and control process without causing conflicts as a result of unclear scope of work.

The results of the Spearman's correlation technique are summarised in figures 5.6 to 5.8. Each box in the figures represents a variable. When two variables are significantly



correlated, they are linked by a line. For example, figure 5.6 shows that the state of completeness of design is significantly correlated with the degree of involvement of site management in decision-making during pre-bid. The shaded boxes represent the variables that are significantly associated with planning performance. For instance, the involvement of estimator is significantly correlated with cost variance. The link between the situational variables and the planning performance variables are derived from the results in chapter 4. These figures could be used by refurbishment project organisations as a guide or model to adjust the degree of involvement of the key participants in order to: -

- a) improve planning performance
- b) to cope with increase complexity and uncertainty of refurbishment projects.

Figure 5.6 Inter-relationships between situational variables, involvement in decision-making and planning performance during the pre-bid stage

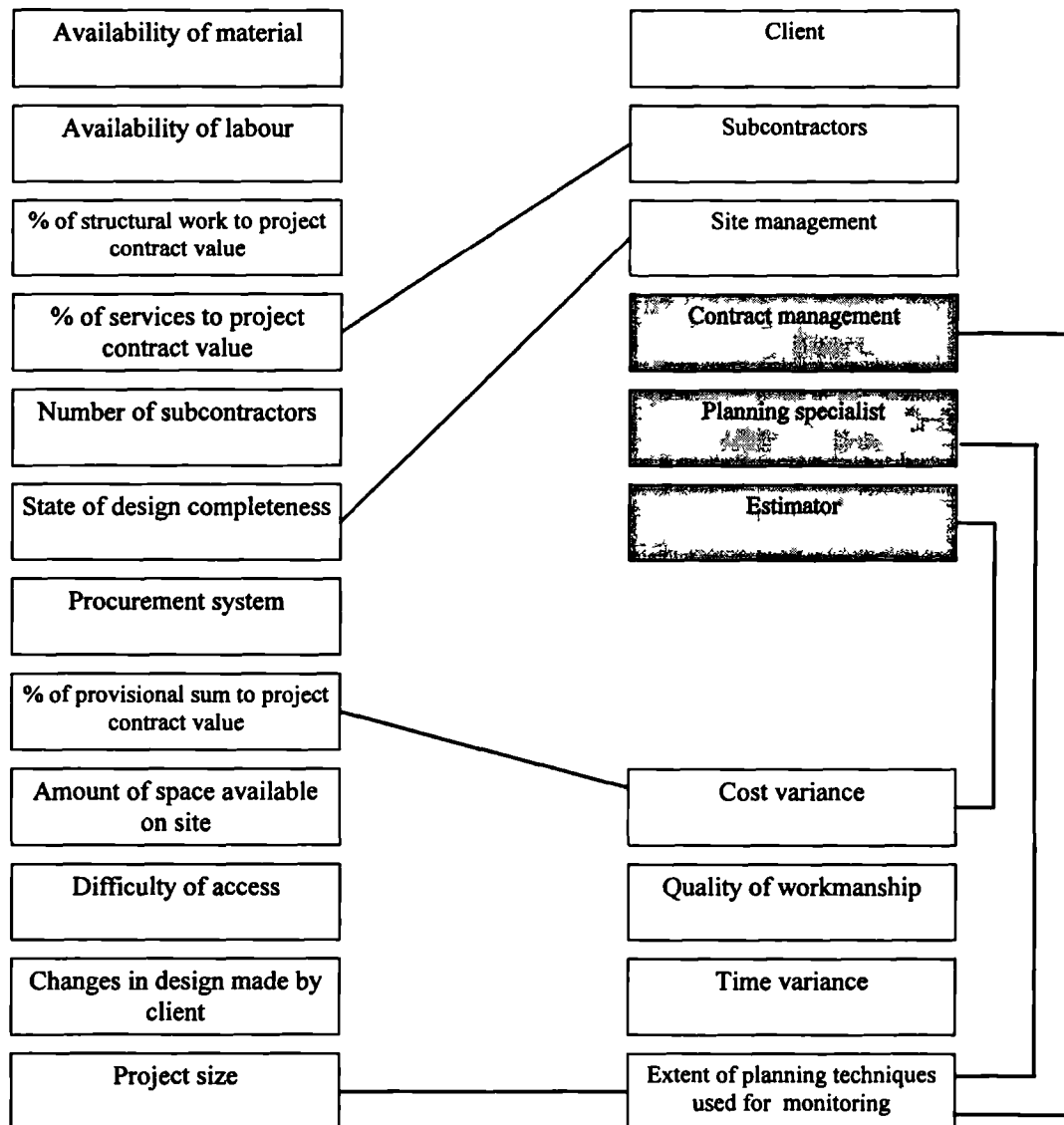


Figure 5.7 Inter-relationships between situational variables, involvement in decision-making and planning performance during pre-construction

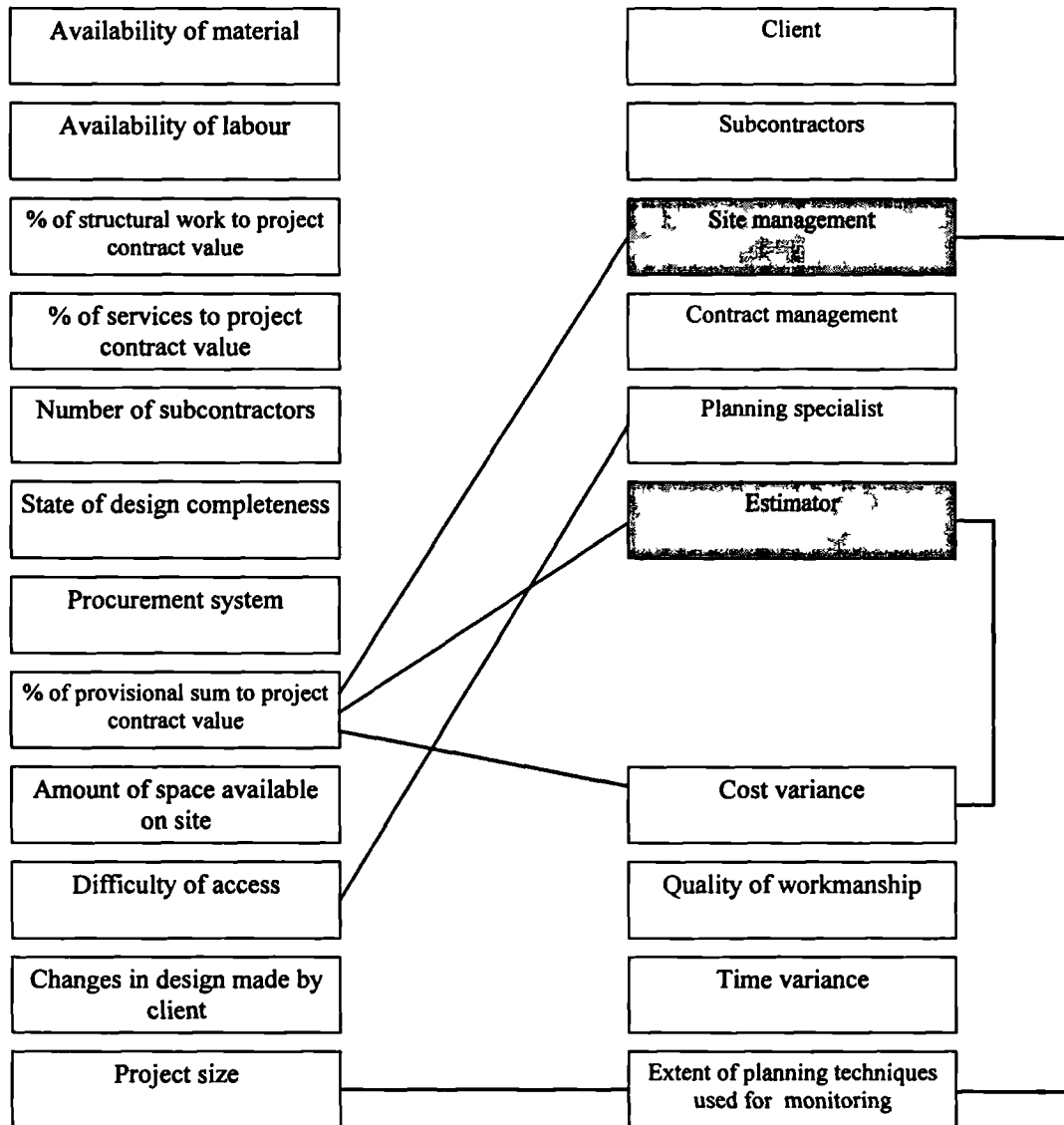
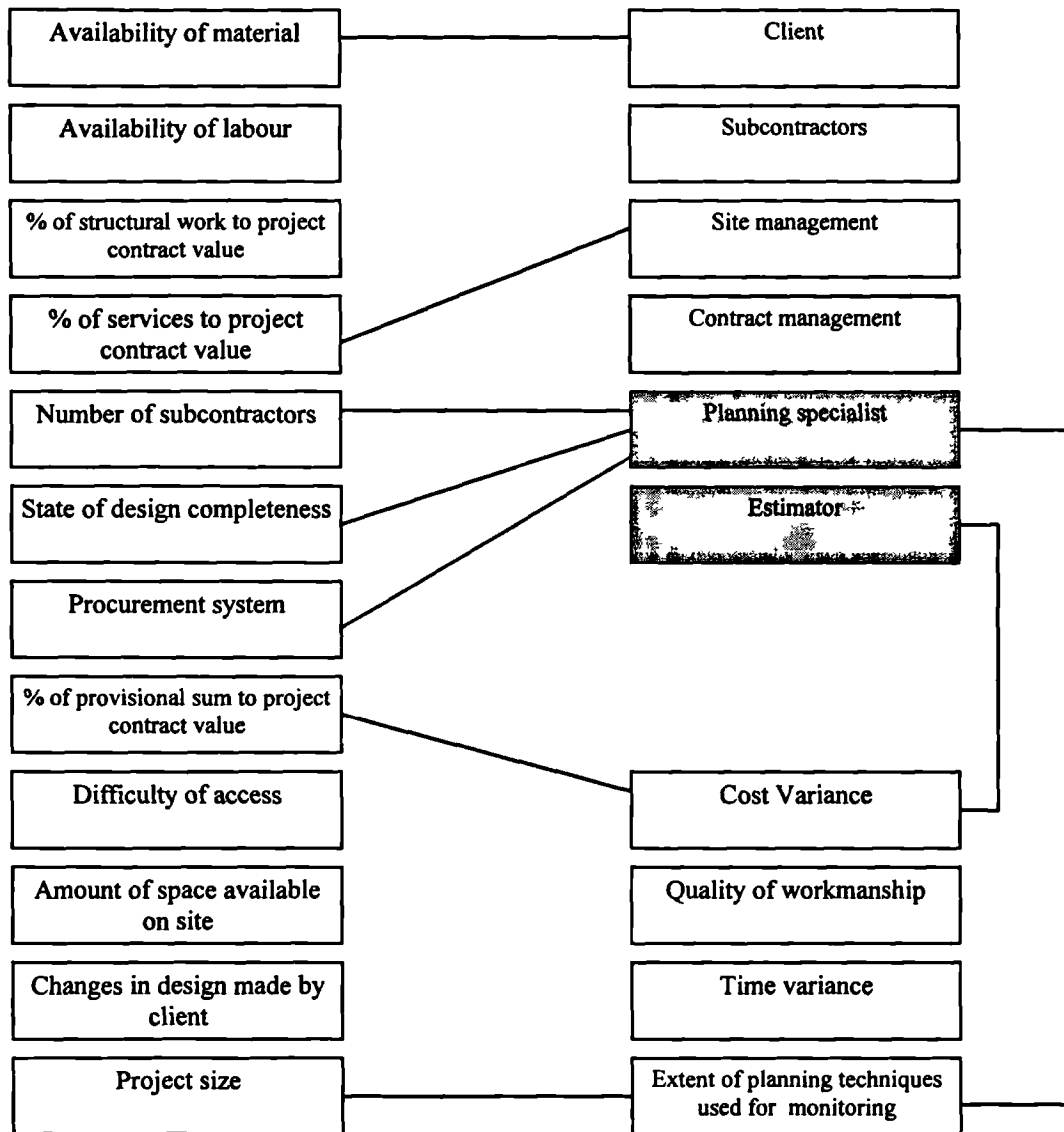


Figure 5.8 Inter-relationships between situational variables, involvement in decision-making and planning performance during construction



The main concern here however that when the key participants venture outside their domain, conflicts may occur. Thus, the roles of the key participants in the planning and control process must be clearly defined. The following guidance should also be useful for the two purposes above and to define the tasks of the key participants. The guidance is produced based on the examination of the results obtained in this chapter and from the literature review. The guidance placed greater emphasis on the areas that require co-ordination among the key participants with the main objective of overcoming the interfacing problems among the key participants.

## 5. 8     Guidance notes for the roles and involvement of key participants in the decision-making the planning and control process of refurbishment projects

### 5.8.1   The estimator

The estimator should be dominant during the pre-bid stage. The scope of estimator's work should be wider than that is found to be practised in many refurbishment projects. The estimator's responsibility should not be limited to build-up the unit rates based on the method statement produced by the contract management for inclusion in the priced bills. The estimator must also be able to control and monitor the collection of tender information throughout the tender preparation. The preparation of estimates requires the estimator to obtain cost information from published literature, other key participants and construction experience. It is vital for the estimator to liaise with planning specialist, to make careful study of all available drawings, specifications, bills of quantities and other relevant information and noting all items such as construction requirements and restrictions which may affect planning requirements. The estimator has to visit the site to ascertain the site working conditions and to visit the architect's office to obtain any missing design information, which may influence the planning and pricing of estimates.

The large amount of data required by the estimator to collect and analyse may require the estimator to have knowledge in information technology and active interactions with other key participants in the planning and control process.

It is also equally important for the estimator to be involved in decision-making on the main aspects of tender and to establish guidelines, along which each department involved in the work, to avoid any abortive work being done. The estimator should also be highly involved in the preparation of method statements, in analysis, alternatives developments and in choice making.

The estimator must be fully integrated during the pre-construction stage. The estimator rather than the director should chair the pre-contract planning meeting. The meeting may be used by construction firms to pass over the tender documentation from estimating to contract departments. The estimator should be able to facilitate the process of adjudication data, build up of net bill rates, summary of subcontractors' and suppliers' quotations, method statements and preliminaries build-up during the pre-construction stage.

In refurbishment projects using partnering schemes, the estimator should be involved in the negotiation. The Estimator, by virtue of his knowledge in refurbishment project costs, is in the best position to provide accurate and more complete cost information in the planning and control process and should be the most appropriate key participant to brief the client on cost saving.

The estimator should be integrated during the construction stage. Communication between the key participants and the flow of information relating to cost would be impaired when the estimator who produces the original estimates and holds the vital cost information is not involved in decision-making at this stage. This is especially true when the percentage of provisional sum relative to contract value is high and design information is incomplete. Cost information is not only complex in nature but also highly sensitive. It also tends to fluctuate throughout the construction stage as new and

additional cost information becomes available and cost adjustments need to be made. The estimator should participate in development of alternatives and choice making of construction methods at this stage.

The above guidance suggests a full time estimator must be employed throughout the duration of a refurbishment project. The estimator should more appropriately be called a 'cost-controller' who should function as an integrator to collect and co-ordinate cost information and be actively involved in decision-making. The estimator should work in close association with site management at all times.

#### 5.8.2 The planning specialist

Few would argue against the integration of cost and time management. This implies that the planning specialist should work closely with the estimator throughout the duration of refurbishment projects. It is suggested that the estimator and the planning specialist are located close to each other and if possible work in the same room. The creation of Production Control Section may be necessary to integrate cost and time control.

The planning specialist should be the dominant participant during the pre-bid stage. The planning specialist should be actively involved in the preparation of the planning technique, method statement and site layout.

The planning specialist, together with the estimator and contract management should visit the architect's office and project site to collect and ascertain missing information. The planning specialist should prepare a checklist of the missing information.

The role of the planning specialist should be enhanced in refurbishment projects with difficult access and small space for storage of material. Under these circumstances, detailed site layout plans are required. The planning specialist needs to liaise with the contract management and site management for this purpose.

During the pre-construction stage, the planning specialist should review the master programme prepared during the pre-bid stage. The planning specialist needs to liaise with the contract management and site management regarding the sequence of work.

In complex and uncertain refurbishment projects, frequent updating of planning techniques is required. Short-term planning needs to be integrated into long-term planning. Low involvement of planning specialist during the pre-construction and construction stages would shift more responsibility to the site management who might suffer shortage of time. In these circumstances, there would be less incentive for the site management to use the planning techniques for monitoring, especially when the planning techniques are solely prepared by the planning specialist.

The planning specialist should be able to help the site management in the preparation of short-term planning during the construction stage. The short-term planning needs to be integrated with the contract programme so the involvement of the planning specialist and the site management on a regular basis is crucial.

Most certainly, the planning specialist needs to play a greater role in decision-making when refurbishment work has started on site with incomplete design. In such situation, there would be a greater tendency for refurbishment project organisations to postpone the decisions to a later stage when more design information becomes available. There would also be greater changes needed to be made in the methods of construction prepared during the pre-bid and the pre-construction stage. The planning specialist would then need to revise and update the long-term plans and to incorporate the revisions in the short-term plans as the refurbishment project progressed during the construction stage. The planning specialist, who functions as an integrator, is in a better position to inform, manage and decide on the additional changes in design information. Increased involvement of planning specialist would increase the efficiency of the flow of information from the pre-bid stage to the construction stage.



In refurbishment projects that employ many subcontractors, the inter-related works among the subcontractors need to be sequenced logically and holistically. The subcontractors need to be co-ordinated closely. The knowledge of the planning specialist who is trained in the preparation of planning techniques, should be fully utilised during the construction stage.

The above guidance clearly shows that planning specialist should be continuously employed throughout the life of the project, working very closely with the site management team. The planning specialist as an integrator performs as 'uncertainty absorbing function' during the construction stage. The planning specialist should lead in the preparation of planning techniques throughout the period of the refurbishment project. This may necessitate the project organisations to assign a full time planning specialist to refurbishment projects.

As an integrator, the planning specialist should be an 'all-rounder', with a good general knowledge of the work of others. He has to maintain a constant liaison with many disciplines and deal sympathetically with their differing points of view. The planning specialist should be analytical, imaginative, and visionary. This requires the planning specialist to pay greater attention to detail and to be systematic in data collection. Skills and knowledge in computer technology are also required. This would help the planning specialist in analysis and graphic presentation.

### 5.8.3 Contract management

It is suggested that the contract management involved during the construction stage must be the same contract management involved during the pre-bid stage. The practice of many construction firms of relying on visiting managers for much of pre-tender advice and periodic site visits would reduce the efficiency of information flow.

During the pre-bid stage, the contract management should help the estimator in the preparation of the site visit report, to prepare the method statement and give advice to the planning specialist in the preparation of the pre-tender programme. The planning specialist and contract management must agree on the programme. The contract management must discuss with the site management on the staffing requirements for inclusion in the contract preliminaries. This is important since it is the site manager who will be held accountable for the performance on site.

The contract management should play a more prominent role during the pre-construction stage. The contract management needs to work closely with the planning specialist and site manager to review the pre-tender document, as a basis for pre-construction planning. This includes finalising the statement of construction methods and schedule of plant and equipment requirements. The planning programme must be checked and approved by the site manager before they are distributed to the relevant key participants in the refurbishment project organisation.

The contract management should lead in the preparation of site layout. Consultations with the planning specialist and site manager are required.

#### 5.8.4 Site management

Even though the impact of integrating site management during the pre-bid stage on planning performance is not totally clear, few would dispute that this would enrich the job of the site management and therefore increase their level of satisfaction. Arguably, they would be more enthusiastic in supervising for work for which they successfully estimated. Besides, the site knowledge and experience of the site management could be incorporated early in the contract programmes.

For complex and uncertain refurbishment projects increased involvement of site management during the pre-bid stage is inevitable. In this situation, increased

involvement of site management could help the estimator and planning specialist to gain better insights to the site problems so that accurate cost and time projections can be made. It could be argued that the skill and experience of site management are vital to interpret design into construction.

However, the need for construction firms to utilise resources efficiently may discourage them from involving site management actively during the pre-bid stage. Therefore, high involvement of site management in decision-making during the pre-bid stage needs to be justified. The main criterion should be the nature of complexity and uncertainty of the refurbishment project. Higher involvement of site management in decision-making during the pre-bid stage is necessary when design information is incomplete.

The site management must be actively involved during the pre-construction stage, working closely with the planning specialist, contract management and estimator. The site management must advise the planning specialist on the preparation and revision of the contract programme and advise the contract management on the preparation and revision of site layout.

The site management should be the leader at the construction stage. The preparation of short-term planning should be the responsibility of the site management. The site management, when necessary should consult the planning specialist and contract management in the preparation of short-term plans. The short-term planning should be produced based on the contract programme and used as control documents.

The site manager should organise weekly planning meeting with the site team and submit progress report to the contract management.

#### 5.8.5 Subcontractors

The subcontractors' involvement in decision-making is mostly low during the pre-bid short-term plans because of the uncertainty faced by the main contractor regarding the award of the contract. Close and long-term relationship between the main contractor and subcontractors would make it easier to integrate subcontractors into decision-making during the pre-bid stage.

The involvement of subcontractors during the pre-bid stage is especially vital for refurbishment projects with high services content. Services work requires highly specialised skill. The majority of the skilled services labour is employed by subcontractor firms. High involvement of subcontractors during pre-bid would enable the main contractors to produce competitive bids.

The subcontractors should be fully integrated during the pre-construction stage. The subcontractors must work closely with the planning specialist in the preparation of the contract programme.

The subcontractors must be actively involved in the revision and preparation of method statements during the pre-construction stage.

The subcontractors must co-operate with site management in the preparation of short-term planning. Weekly discussion with the site management on the provision of adequate resources may be necessary.

#### 5.8.6 The client

From the semi-structured interview conducted by the author, the majority of planning and control managers agreed the clients' involvement in decision-making during the pre-construction and construction is not always welcome. One planning and control manager

said that the clients are not employed by construction firms. In most circumstances, the construction firms have very little influence to increase the involvement of the client in decision-making. There would also be little inclination for the clients to be involved, since once the refurbishment projects are contracted, the risks would have then be shifted to the contractors. Even though, when the clients wanted to be involved, their lack of technical expertise on site problems could only become a hindrance. Another planning and control manager said that once the contractors have possession of the refurbishment project sites, interference from the clients is considered to cause more problems and disruptions to the contractors' works. The clients are only welcome to increase their involvement under circumstances beyond contractors control.

Laufer (1996) however, suggested that the owner's leadership is not only vital in the initial stage towards project integration, but during project execution. A common feature of the owner's involvement is his role as a link between the various organisations involved in the project.

Young et al (1996) however, maintained that the involvement of the client/client's representatives at the construction stage is vital especially in terms of providing appropriate quality and timely information. Uncertainty relating to difficulty of access, lack of space for storage of material and incomplete design for instance could be tackled more speedily. Their presence could also help with prompt decisions and settlement of site problems as they occur.

It is suggested that client's involvement during the construction stage should be in the main, for providing the missing information in the planning and control process. Regular informal contact with the contractors' team, especially with the contract management, should be encouraged, but not to the extent of interfering with daily operation of the refurbishment project.

## 5.9 Summary and recommendations

This chapter begins with the definition of 'planning' and 'control'. The review of literature reveals that planning cannot be separated from control. The two processes merged to form an integrated process.

The relative involvement of the key participants, which include the estimator, planning specialist, contract management, site management, subcontractors and client in decision-making were investigated. It was found that there was a high degree of specialisation of key participants in decision-making in the planning and control process. High levels of specialisation produces high levels of differentiation. All the key participants, except the client, have their own domain.

There are two distinct groups of key participants employed in the construction firms. They are the long-term planners (estimator and planning specialist) and the short-term planners (contract management, site management and subcontractors). The long-term planners' domain is the pre-bid stage. The short-term planners' domain is the construction stage. The planning specialist and contract management who are strongly involved throughout the period of the refurbishment project are identified as the integrators. The client's involvement in decision-making was found to be one of the lowest in all stages of the refurbishment project. The pre-bid stage was found to be the least integrated stage.

The three major factors that cause differentiation are:

- To avoid conflicts of tasks.
- Contractual systems.
- The shortage of time of project for site management to plan.

The planning specialist, contract management and site management were also found to have skills and knowledge in the preparation of plans. This is reflected in their strong

involvement in the preparation of planning techniques, short-term plans, method statement and site layout.

The differentiation in the planning and control process was argued to cause a decision-making gap. The implications of decision-making gaps are: -

- Inefficient flow of communication.
- Differences in attitudes.
- Power conflicts.

It was hypothesised that the complexity and uncertainty of refurbishment projects require greater integration and therefore require strong involvement of all key participants in decision-making at all stages of refurbishment projects. This hypothesis was tested by establishing the correlations between the involvement of the key participants in decision-making and planning performance. The results were found to be mixed. It could be concluded that differentiation and integration are both required in the planning and control process of refurbishment projects. The evidence for the need of integration were: -

- Increased involvement of the estimator in decision-making during the pre-construction stage is associated with decreased cost variance.
- Increased involvement of the estimator in decision-making during the construction stage is associated with decreased cost variance.
- Increased involvement of the planning specialist in decision-making during the construction stage is associated with increased use of planning techniques during the construction stage.

There is no evidence that increased involvement of site management and subcontractors during the pre-bid stage could significantly improve planning performance.

The two conflicting needs of differentiation and integration require the roles of the key participants to be clearly defined. The last section of this chapter identifies the areas in which the key participants need to interface with one another. This section could be used by the key participants for guidance in defining their roles in the planning and control process of refurbishment projects.

There were indications that the involvement of the key participants needs to be adjusted depending on the nature of the complexity and uncertainty of the refurbishment project. It is recommended that further research should be conducted in this area. This will help to establish how the roles of the key participants should be adjusted under different project situations.



## **Chapter 6**

### **Co-ordination devices**

#### **6.0 Introduction**

It has been established in chapter 5 that the involvement of the key participants in decision-making in the planning and control process are differentiated. It has been argued that differentiation causes communication gaps, power conflict and differences in attitude.

The results in chapter 5 show that multiphased integration in which the key participants increase their involvement in decision-making outside their domain appears to improve certain aspects of planning performance but not in others. Hence, it was concluded that multiphased integration alone is not sufficient and must be supplemented by other integrative mechanisms to increase the level of planning performance of refurbishment projects.

Etzioni (1963) maintained that most organisations could not rely on most participants to internalise their obligations to carry out their assignments voluntarily, without additional incentives. This view is supported by Galbraith (1977) who maintained that in order to perform well, individuals must undertake unnatural and sometimes unpleasant behaviour. It cannot be taken for granted that the participants involved in a project organisation will increase their involvement when they are faced with increased uncertainty.

Galbraith (1977) suggested a number of integrative mechanisms such as procedures and lateral relations, which could be used to provide incentives for the key participants to increase the information processing capacity in any organisation. Bennett (1991) identified these integrative mechanisms as co-ordination devices.

The objectives of this chapter are :-

1. To establish the types and the extent to which the of co-ordination devices are used in the planning and control process of refurbishment projects.
2. To establish the relationships between co-ordination devices used and the planning performance of refurbishment projects.

### 6.1 The co-ordination devices

Galbraith (1977) said that the greater the uncertainty of the task, the greater the amount of information that has to be processed during the execution of the task. If the task is not understood, then during the actual task execution more knowledge is learned which leads to changes in resources allocations, schedules, and priorities.

According to Galbraith (1977), more information must be processed in a complex organisation than in a simple one. The degree of interrelatedness or interdependence of the tasks within an organisation could also influence the degree of uncertainty. The behaviour in one department tends to affect the goal accomplishment of another. Thus one department in an organisation needs to communicate with other departments units that could be affected by a scheduled change and resolve the decision in the best interest of the organisation collectively. The use of co-ordination devices such as procedures, communication skills and knowledge, lateral relations and information systems could be used to serve this purpose.

This view is supported by Kerzner (1984) who said that because of interfacing problems, management began searching for innovative methods to co-ordinate the flow of work between functional units without modification to the existing organisation structure. This co-ordination was achieved through several co-ordination devices.

According to Bennett (1991) the use of co-ordination devices would help to reduce the communication barriers or gaps that could emerge from message distortion,

information overload, suitability of messages for a particular audience, semantic impression, lack of opportunities for communicating, inability to listen and membership of a reference group.

The main concern of refurbishment project organisations is that an increase in the use of co-ordination devices requires an increase in the use of the organisation's resources. Refurbishment project organisations are not only concerned with performance, but also with efficiency. The project organisations have to be selective in implementing the co-ordination devices. They must be suited to the needs of the projects and the needs of the long-term objectives of the construction firms. To increase the use of all the co-ordination devices without any specific reasons would not be cost-effective.

Because of this, Chapman et al (1985) proposed that the entire construction industry needs to change its attitudes and apply a contingency approach. No single approach is best in all situations, and that policies and methods must be tailored to circumstances.

An empirical study by Van de Ven et al (1976) reveals that even though an organisation uses all mechanisms of co-ordination, in certain circumstances, they have to make a trade-off between the various modes. For instance, some co-ordination devices such as meetings tend to increase with an increase in task uncertainty. The use of rules and planning, on the other hand, declines with increased uncertainty. But in general, the co-ordination devices are added to the organisation's repertoire rather than substituted one for the other.

The co-ordination devices could be used to co-ordinate the involvement of the key participants in decision-making, which in turn could further reduce the communication gaps in refurbishment project organisations. Most certainly, a project in which different key participants use standardised procedures, and use the same terminology would increase the efficiency of information flow. In such a situation, there would be less tendency for conflicts to occur which are prevalent in an uncertain project.

This chapter hypothesises that the complexity and uncertainty of refurbishment projects requires a combinations of co-ordination devices in the planning and control process.

Four major co-ordination devices gleaned from the literature review are tested in this chapter. The co-ordination devices are: -

- a) Lateral relations (meetings and direct contacts).
- b) Construction company planning and controlling procedures.
- c) Communication skills and knowledge of the key participants.
- d) Information technology.

The extent to which the co-ordination devices are used in the refurbishment projects are discussed in turn below.

## 6.2 Lateral relations

Galbraith (1977) and Bennett (1991) maintained that one way of increasing a project organisation's information processing capacity is to employ lateral relations, which include meetings and direct contacts. This is the mode in which the decision processes cut across lines of authority. Lateral relations decentralise decisions but without creating self-contained groups. Lateral relations remove overloads from management hierarchy when problems involving key participants at the same level of management arise. The problems are solved locally.

Lateral relations provide greater flexibility, since decisions could be made as needed, but require greater amounts of managerial time spent in group processes and the overhead expense of the liaison and integrating role. According to Bennett (1991) the arrangements appropriate for any particular project depend on the amount of information to be communicated and the difficulty of the problems likely to arise.

It could be argued that it is important for managers to get information formally and informally through direct contacts. Direct informal contacts, especially have the

advantages of creating an informal culture in handling the uncertainty, and detecting and correcting hidden problems speedily.

During the semi-structured interview of this study, a planning and control manager revealed that a high proportion of information needed to plan and control in refurbishment projects is obtained through direct contact between the key participants. In fact, one planning and control manager stressed that this was the most important mode of obtaining information.

#### 6.2.1 Direct contact

Two types of direct contacts were identified in the literature review, the direct formal contact and direct informal contact (Bennett, 1991).

The direct formal contact is the term used when the information is obtained either by correspondence, reports or memos. The information obtained is documented. The information obtained through direct formal contact could be used as evidence for the settlement of final accounts and in the event of litigation. This mode is most widely used between key participants employed in different organisations, such as between the main contractor and subcontractors or client and main contractor.

The purpose of a co-ordination device is to increase information processing capacity in an organisation. Its importance to the organisation could be seen in terms of the extent to which it is used as a method of obtaining information.

The importance of direct formal contact as a method of obtaining information in the planning and control process of refurbishment projects was sought in the present study. The response was recorded on a five-point scale ranging from 1 not important to 5 very important. The exact measurement and wording is shown in appendix L. The result is shown in table 6.1.

**Table 6.1 The importance of direct formal contact as a method of obtaining information in the planning and control process of refurbishment projects**

The degree of importance	Refurbishment projects (N = 65) %
Least important	6.1
Not important	20.0
Neutral	23.0
Important	27.7
very important	23.0

Table 6.1 reveals that direct formal contact is an important/ very important method of obtaining information in 50.7% of refurbishment projects. This result indicates that formal interaction is an important characteristic in the planning and control process.

This result came as a surprise. Mintzberg (1994) argued that formalisation creates inflexibility. According to Boyd and weaver (1994), inflexibility can force people to perform in an inappropriate way. It is the management of informal and flexible system that allows the complex inter-relationships between the numerous parties carrying out the activities to drive refurbishment projects to completion. If this argument is accepted, then formal interaction should not be important in the planning and control process.

There are two convincing reasons to reject this argument. Firstly, formalisation is necessary to provide framework from which the informal system can be built to accomplish the objectives of the project (Higgin and Jessop, 1965). Secondly, conflicts are more likely to occur in refurbishment projects which are noted with a high level of uncertainty. In order to fulfil contractual obligations, and to avoid conflict and litigation, direct formal contact becomes an indispensable mode of communication within refurbishment project organisation, even though it is not the most efficient way. Thus it could be suggested that contractual constraints play an

important part in determining the efficiency of planning and control of refurbishment projects. The lack of trust between key participants employed in different organisations most certainly increase the importance of direct formal contact as a method of obtaining and disseminating information.

Young et al (1996) argued that more needs to be done by both the contractors and clients from the construction refurbishment industry to improve the nature of the working relationship between both parties in carrying out refurbishment works.

Young et al (1996) compared the degree of trust between members of the clients' and contractors' team in ship refurbishment and construction sectors. It was found that 84.6% and 45.5% of respondents from ship refurbishment and construction sectors, respectively, noted that there was a fairly high/high level of trust.

Also in Young et al (1996) study, it was found that 76.9% of respondents in ship refurbishment, as compared to 18.2% in construction, noted that as far as agreeing variations to refurbishment works were concerned, they were 'always agreed' or 'high level of agreement'.

Young et al (1996) identified three reasons for low level of trust between contractors and clients.

- Inappropriate choice of contract procurement system. This includes contract drafting, interpretation by both parties and sharing of risks.
- Unclear and ill-defined project briefs have the effect of increasing the levels of variations during the refurbishment process. This could disrupt the contractors' programme, leading to project delays, which could lead to unsatisfactory relationships between the clients and contractors.
- Unsuitable contractors unable to interpret and implements client' briefs. It was revealed that some contractors deliberately put in low and non-realistic bid just to win a particular contract, with the view of making profits by raising and pricing numerous variations in the works.

It has been argued that partnering systems could improve business relationships between client and contractors. However, the complexity and uncertainty of refurbishment projects could deter the parties from entering this arrangement. Besides, the dissatisfied partners can always seek legal redress under the terms of their contract.

Conflicting objectives could also play a role in the low level of trust in refurbishment projects. CIRIA (1994: p. 12) for instance said;

‘Lack of certainty arising from unclear or conflicting objectives is one of the most important problems connected with refurbishment projects. It affects the development of the brief, the design, the choice of contractual arrangements and the execution of the work. It adversely affects morale, tends to produce confused and undisciplined thinking and prejudices the likelihood of a successful outcome. The basic objectives of cost, time and quality which are present in all projects are often supplemented on refurbishment projects by major objectives such as minimal disruptions to the operation of the building or safety.’

Complete design information and small changes made by the client during the construction stage could certainly reduce variations and improve trust between the clients and contractors. This is however, difficult, if not impossible in refurbishment projects. A more appropriate option is to build informal culture and teamwork through direct informal contact. Thus formality must be complemented with informality in the planning and control process.

Boyd and Weaver (1994) maintained that the advantages of informal culture in handling the uncertainty were that hidden problems could be revealed so that their expectations about accountability could be assessed against cost.



### 6.2.2 Direct informal contact

The direct informal contact is the term used when the information is obtained by telephone or through informal conversation. The information obtained is less structured. The direct informal contact could be useful when information is needed speedily especially when bureaucracy burdens the project organisation.

Bennett (1991) observed that when no formal arrangements are built into a project organisation, direct informal contact will emerge. This phenomenon, according to Bennett (1991) is so common that it has been given a name: the grapevine.

Even when there are formal arrangements, there would still be a tendency for direct informal contacts to take place especially during the early stages of construction projects (Laufer, 1996). These informal contacts are mostly ad-hoc on a one-to-one basis such as outside the office, in the corridor, at the photocopy machine and in the cafeteria to clean-up ideas or to reconcile difference. They help to remove obstacles and accelerate the pace of understanding. Laufer (1996) observed that in successful construction projects, the teams or key participants are co-located.

Pietroforte (1977) argued that when information remains uncertain, and it is not well codified, transactions are generally conducted on an informal or non-contractual basis. The lack of information certainly is balanced by socialisation processes that facilitate the development of common values and trust. The lack of clear criteria makes this process much slower, because it is subjected to continuous negotiation and the use of several communication channels for achieving mutual understanding. In this regard, the quality of the personal relationships between the key participants is an important factor for the efficiency of the exchange.

The importance of direct informal contact as a method of obtaining information for planning and control of refurbishment projects was sought in this study. The result, presented in table 6.2 reveals that direct informal contact is an important/most important method of obtaining information in 57.0% of refurbishment projects, compared to only 50.7% for direct formal contact.

Table 6.2 The importance of direct informal contact as a method of obtaining information in the planning and control process of refurbishment projects

The degree of importance	Refurbishment projects (N = 64) %
Least important	4.6
Not important	10.9
Neutral	26.5
Important	23.0
Very important	34.0

The above result indicates that direct informal contact is a more important co-ordination device than direct formal contact in the planning and control process. This indicates that informal interactions which encourage close personal relationships and teamwork are important in refurbishment projects.

Few would argue against the fact that direct informal contact could increase the responsiveness and induce teamwork. The importance of teamwork is eloquently expressed by CIRIA (1994:p. 34) who said;

‘Therefore the management and conduct of human relations are the main concern in refurbishment projects. The distinctive staffing and skill requirements of refurbishment are less a matter of finite technical considerations than more elusive ones like disposition and attitudes. Many practitioners in refurbishment who participated in the research spoke of the inflexible attitudes that need to be overcome if the organisational efficiency of refurbishment projects is to be improved. Emphasis needs to be placed on responsiveness, adaptability, teamwork and above all, on the importance of people, their enthusiasm, their enjoyment of the work and their desire to do well’.

Most certainly, direct informal contact could be better facilitated if the key participants in refurbishment projects are co-located, and provided with adequate communication facilities such as e-mail and telephones, local area networks and more recently, the Internet and Intranet.

To operate effectively, it is vital to place the planning specialist in the closest proximity with the contract management as is organisationally possible. This will enable the planning specialist to influence the course of action and monitor the progress of the project more closely.

From the visit to the construction firms during the semi-structured interviews, the author discovered that there were different strategies employed by the construction firms in fostering teamwork. In the majority of construction firms, the planning and control managers were separated based on their positions. For instance, the contract management are located in one room and the planning specialists in another.

However, in three construction firms, planning specialists, contract management and estimators were all located in an open floor office. Estimators and planning specialist were placed next to each other. This arrangement was obviously to encourage direct informal interactions between the key participants.

Bennett (1991), however, cautioned the drawbacks of placing too much emphasis on direct contacts. They tend to divert the participants away from their direct team management responsibilities and the interest of the project as a whole could be compromised. In a uncertain refurbishment projects, the information on planning and control tends to decay very fast. Information that is considered to be current to one key participant may be already out-of-date to the others. Even at low levels of interaction, the costs of relying on direct contact can easily exceed the benefits. Meetings are frequently held to reduce conflicts and to ensure that all key participants receive current information.

### 6.3 Meetings

The purpose of meetings is for the key participants to meet regularly to keep each other informed and to handle shared problems arising in the project. Laufer et al (1992a) said that there is a need to provide prompt feedback and perform planning in the very course of execution. Feedback that links control and planning should form an integral part of all meetings, discussions and actions.

In fact, meetings are used so widely in planning and control of construction projects that they have been considered by some construction management writers as an informal mode of planning and control (Cohenca-Zall, 1993 and Laufer and Cohenca, 1982).

Cohenca-Zall (1993) cited three reasons why meetings could be considered as an informal mode of planning.

- Whatever planning is carried out by meetings it is not performed elsewhere, nor is it articulated in other documents.
- The major portion of detailed planning during construction results from meetings.
- Not all of participating parties in planning, described in previous section, pertains to meetings. Part of it is certainly associated with the formal, analytical, rigorous mode of planning (i.e. the scheduling engineer prepares a revised CPM during construction).

According to Cohenca-Zall et al (1993), on the one hand, planning can be formal, performed mainly by quantitative analysis and yielding rigorous, data based solutions, or it can be informal, heuristic planning and heavily based on intuition and experience on the other. In the pre-bid and pre-construction planning stages, the formal mode is dominant while during construction the informal modes predominate, conducted in various meetings. The output of these meetings is usually a textual format as direct output. They address all planning areas and in particular scheduling and those pertaining to technology such as site layout and method statements. The meetings are also engaged in current issues, such as lack of drawings and solving conflicts (organisational and

technical) and short-term co-ordination and control. As the construction project advances and the levels of complexity and uncertainty are falling, planning by meeting gradually diminishes.

Arguably, if all the numerous planning tasks identified by Cohenca-Zall et al (1993) were conducted during scheduled project meetings, there would be insufficient time to perform co-ordination, which is the main function of meetings. Also, there would be insufficient time to perform planning adequately. Planning, according to Mintzberg (1994) needs formalisation, systematic data gathering, analysis and employment of formal presentation in the form of planning techniques and is, therefore, time consuming. To perform those tedious tasks, which may be of little interest to some of the key participants attending the meetings, would not be cost-effective.

In the light of this, it could be viewed that Cohenca-Zall et al (1993) are playing with semantics, using the words *planning* and *co-ordination* interchangeably. Besides, Cohenca-Zall (1994) admitted that during the interviews conducted in their study, many construction managers found that to view meetings as a mode of planning to be 'a fresh (and even, to some extent, surprising) concept'.

Nahapiet and Nahapiet (1985) took the view that meetings as integrating mechanisms or co-ordination devices, thus separate from the planning and controlling system. The purpose of these mechanisms, which are generally regarded as more flexible than formal systems, is to enable mutual adjustments and adaptation through personal discussion and communication. Management of these activities should occur across the interfaces between the groups employed by different organisations involved in the project, rather than within each participating organisation. Nevertheless, Nahapiet and Nahapiet (1985) acknowledged that in some cases, the minutes of such meetings replaced formal reports as control mechanisms.

This study takes the view that meetings play a dual role, but mostly as co-ordination devices and in some circumstances, as an informal mode of planning. The circumstances in which meetings function as a mode of planning is when the information is incomplete and volatile (or even missing) and there is a need to provide prompt feedback. In such

circumstances, meetings provide the opportunity to set out the issues for which decisions need to be made. Latest information could be gathered for all key participants. The meetings also provide a means of processing this information, making choice and testing commitments. Also, information can be distributed to and acknowledged by all participants.

These circumstances are prevalent in refurbishment projects. Young et al (1996) in their study 'Managing Refurbishment Works in the Construction and Shipping industries' interviewed 36 key personnel involved in the refurbishment processes in both construction and shipping sectors. From the interviews they found that meetings or informal planning techniques are considered by all those interviewed as vital for refurbishment work. Over 70.0% of the interviewees were of the view that informal planning techniques are more important than formal techniques.

Young et al's (1996) study found that various forms of informal planning and control techniques (meetings) were carried out in refurbishment projects. The client's and contractor's meetings appeared to be the most frequent, followed by meetings between the main contractor and the subcontractors.

Young et al (1996) study also suggested that successful accomplishment of a refurbishment project is dependent on the appropriate mix of the application of both formal and informal techniques. The informal techniques are important in accommodating the kind of flexibility which refurbishment works demand. The formal techniques ensure that the management team abides by the formal and structured objectives set for project completion.

The main concern, however, is how to ensure that the meetings are effective if they are to function as planning. Most certainly, meetings will fail to function as planning if they are called with too short a lead-time and do not give enough time for the key participants to gather information that might be necessary to analyse and make decisions. Accurate planning cannot be achieved, if the key participants have to make impromptu decisions because information is gathered hastily, processed and distributed all at the same time during the meetings. Worse, if the decisions that need to be made are not relevant to the

majority of the key participants. Pressed with time, these key participants would want to speed up the meetings, which would invariably fail to produce accurate plans.

The circumstances highlighted above suggest that the preparation of policies and procedures are necessary to support the implementation and operation of meetings. They also suggest that the lack of formalisation is the main reason that reduces the capacity of meetings to function as planning. This brought to mind Mintzerg's (1994) objection to 'going to mountain retreat and to talk about strategy as planning' and of him deriding 'flexible planning' as oxymoron.

Few, however, would deny the function of meetings as co-ordination devices. Kerzner (1989) viewed that meetings, as co-ordination devices work best for non-repetitive tasks and projects. This view is supported by Galbraith (1977) who cites studies reporting that higher uncertainty results in a higher frequency of scheduled and unscheduled meetings. A similar conclusion was made by Nahapiet and Nahapiet's (1985) case studies in the United States and the United Kingdom. Guevara (1979) who conducted an empirical study that focused on communication in construction companies found that the most frequent measure to improve communication in construction companies, suggested by 42 construction executives was more meetings to inform, plan and co-ordinate work between departments.

Laufer (1996) maintained that formal meetings should be encouraged, adhered to and project members should participate in the decision-making process.

In general, there are two types of meetings carried out in construction projects. They are regularly scheduled meetings and unscheduled meetings (Cohenca-Zall et al, 1993).

#### 6.3.1 Scheduled meetings

Scheduled meetings are attended by the majority the participants involved in project organisations. They are held at regular interval. Examples of such meetings are site

and owner-contractor-architect meetings, which are held monthly, and team and subcontractors meetings, which are held weekly.

According to Cooke (1993) the functions of monthly site meeting are to co-ordinate requirements and review the progress of the construction project. They are attended by the main contractor and his principal subcontractors, any professional consultants employed by the client, the architect and clerk of works. The meetings are conducted in a formal manner with agenda sent out beforehand and minutes circulated preferably not later than one week after the meeting has taken place.

According to Cooke (1993), well organised site meetings will help towards providing a new impetus to the construction project by enabling re-organisation where delays or difficulties have affected the programme. Site meetings assist in resolving conflicts between the various parties. Within certain organisations a subcontractor's site meeting will be held immediately prior to the monthly meeting. This enables the phasing-in of subcontractors' work to be discussed and any problem areas highlighted during the monthly meeting.

The weekly meetings on the other hand, are mostly informal, addresses short-term planning issues, and focuses on actions and details (Laufer et al, 1994)

From the preliminary postal questionnaire survey, the result of which is shown in table 6.3, in 72.0% of refurbishment projects, scheduled meetings are important/very important method of obtaining information. The mode is most important. This result suggests that scheduled meetings are a very important co-ordination device for refurbishment projects.



**Table 6.3 The importance of scheduled meetings as a method of obtaining information for refurbishment projects**

The degree of importance	Refurbishment projects (N = 65) %
Least important	3.0
Not important	7.7
Neutral	16.9
Important	35.8
Very important	36.9

The result reflects the importance of joint decisions and interrelatedness of decisions in refurbishment projects. It is important for the key participants to gather, update and document information regularly and systematically and to be presented clearly during meetings. Standard forms and terminology may be useful for recording and documenting of information. The use of computer technology should be able to improve data gathering and documenting information. Meetings, however, take considerable time and financial resources and therefore need to be conducted efficiently.. The latest project information which includes minutes, drawings and programmes that need to be discussed during meetings should be distributed to the relevant key participants, well in advance.

### 6.3.2 Unscheduled meetings.

Unscheduled meetings are often held when there is an urgent need to consult and decide on urgent issues. The unscheduled meetings are normally attended by the majority of the key participants to discuss a concern of one of the key participants. Cohenca-Zall et al (1993) found in some construction firms, the obligations for the party who called the meeting are that; a) there is a cause for concern, b) a minimum of 48 hours notice, an agenda must be provided and they are to prepare and circulate minutes promptly after the meeting. The main issues normally discussed in these

meetings are planning and review of time table, missing design information, co-ordination of field activities, scheduling and review of past progress.

Table 6.4 reveals that unscheduled meetings are an important method of obtaining information in the planning and control process of refurbishment projects. It is considered to be important/very important as a method of obtaining information, hence as an co-ordination device, in nearly 60% of the refurbishment projects. The mode is important. This is a rather high figure, almost as important as scheduled meetings. The result indicates that unexpected events were common in the refurbishment projects. It also reflects the high degree of interdependency of tasks of the key participants. The problems of a key participant tend to affect the tasks of other key participants, thus necessitating unscheduled meetings. This result supports Galbraith's (1977) observation that the higher the uncertainty, the higher the frequency of scheduled and unscheduled meetings.

Table 6.4 The importance of unscheduled meetings as a method of information in refurbishment projects

Degree of importance	Refurbishment projects (N = 65) %
Least important	3.1%
Not important	12.3%
Neutral	26.2%
Important	32.3%
Very important	26.1%

The importance of unscheduled meetings reflects the needs of the key participants to be flexible and responsive. It implies that the firms involved in refurbishment projects should not be bureaucratic. The need for the key participants to attend frequent unscheduled meetings may affect other activities within each participating firm. The key participants may have to forgo the needs of other projects in order to attend the many unscheduled meetings in refurbishment projects. This implies that there is a greater need for the key participants to be assigned full time in a particular

refurbishment project. This may incur higher overheads to the firms involved in the project. The practice of some construction firms that assigned a planning specialist to be involved in four or five refurbishment projects at once could be called into question.

Among the four modes of lateral relations, both scheduled and unscheduled meetings were found to be more important as sources of information than direct contacts. There are plausible explanations. Firstly, the information could be obtained more efficiently through meetings when the majority of the key participants are present. This is rather obvious, as during meetings exchange of ideas flow more efficiently between the key participants. Meetings provide greater opportunity to integrate the decisions of all key participants, than direct contacts. Laufer (1996) argued that tightly structured groups learn to communicate faster as they progress through the problem and their performance. Secondly, meetings also provide greater opportunity to handle the issues in planning and control holistically. Besides, the information disseminated in the meeting would be documented and therefore more structured and could be stored for reference. Hence, formal meetings should be encouraged, adhered to and project members should participate in the decision-making process.

#### 6.4 Construction company planning and controlling procedures

Procedures are standards that specify actions that need to be taken in any given situations. If the key participants are given the discretion to make their own choices, different key participants may decide on different approaches. The result, as articulated by Bennett (1991: p.88) was 'extra work in learning several different approaches, reconciling information from different sources which is inconsistent, searching information when it is unclear whether it does or does not yet exist, and generally wasting time dealing with information, rather than being able to concentrate in designing, manufacturing or constructing the end product'.

Galbraith (1977) maintained that the virtue of procedures is that they eliminate the need for communication between interdependent parties and between superior and

subordinates. If all key participants adopt the procedures, which in turn produce appropriate behaviour, the aggregate response is an integrated or co-ordinated pattern of behaviour. The decisions of the key participants involved in the process could be anticipated in advance. This would enable the communication channels to concentrate on those decisions that cannot be anticipated in advance.

Koontz and O'Donnel (1972), however, warned that procedures, apart from human psychology, company policies and capital investment could cause inflexibility in an organisation. March and Simon (1958) and Hage et al (1971) said that the less routine and the more diverse the situations, the less one chooses programming or procedures as a co-ordination device. Thus. It could be argued that because of the need for flexibility in refurbishment projects, the use of procedures as a co-ordination device might be limited.

Stinchcombe (1959) in his study titled, 'Bureaucratic and craft administration of production: a comparative study' compared the work processes between manufacturing industries in construction. He found that more work processes such as the movement of tools, materials and people in manufacturing industries follow standard procedures than in construction industries. The workers in the construction industry who are faced with greater uncertainty, have more discretion in their work.

The findings of the two studies above imply that the use of procedures tends to cause inflexibility. This limits the use of procedures in refurbishment projects which are characterised by high degree of uncertainty. Interestingly, the result from the final postal questionnaire survey of this study proved to be otherwise.

In the final postal questionnaire survey, the extent to which the construction firms' planning and control procedures were used by the key participants in the refurbishment projects were sought. The exact wording and measurements are shown in appendix L. The result is shown in table 6.5.

Table 6.5 The extent to which the construction firms planning and control procedures were used by the key participants in refurbishment projects

Rating	Refurbishment projects (N=67) %
Very small extent	5.0
Small extent	1.5
Neutral	17.9
Large extent	50.7
Very large extent	23.9

Table 6.5 reveals that the construction firms' planning and control procedures were used to large/very large extent in 75% of the refurbishment projects.

There is a plausible explanation. The tasks to be performed in the planning and control process of refurbishment projects are numerous, some are affected by uncertainty, and some are not. The new unique problems are treated as exceptions and referred to the hierarchical position where a shared superior exists for all affected subordinates. For routine tasks, standardised procedures are used. This combination guarantees an integrated co-ordinated response from the organisation both for routine and non-routine situations. There are many procedures used in the planning and control process to tackle many routine tasks.

The short-term planning procedures for instance specify among others, the types of planning techniques to be used, the planning horizon, the methods of monitoring and the forms to be used for assessment of operational times. The nature of the complexity and uncertainty of refurbishment projects has very little influence on the extent to which these procedures may be used by the key participants involved in the planning and control process. During the semi-structured interview, a planning and control manager informed the author that the proliferation of forms used in the planning and control process reflects the many routine tasks undertaken in refurbishment projects. The procedures for material and plant acquisitions are examples of routine procedures.

However, there would be planning and control procedures which are vulnerable to task uncertainty. As organisation's subtasks increase in uncertainty, fewer situations can be programmed in advance and, therefore, less likely for standard procedures to be used.

To cope with uncertainty, Laufer (1996) suggests that construction companies would do well to prepare simple procedures that require only minimum paperwork and approval, which could be easily be adjusted to cope with the uncertainty of construction projects. (Laufer (1996: p. 196) observed that;

‘ The design of the procedures takes into account that different projects require different actions that cannot be spelled out in one standard procedure. The procedures are therefore designed to allow flexibility with an emphasis on ‘what’ describing mainly the product (i.e. documents) of the procedures. On the ‘how’ side there is only a general outline of the process’.

It could be argued that procedures could help to serve the hierarchical needs, that is to say, to strengthen more the lateral ties between the implementers and the decision-makers. When the procedures are designed, great emphasis is laid on the fact that they reflect the uncertainty of refurbishment projects as closely as possible, and that adherence to the procedures provides a distinct value to the refurbishment project organisations. The design of procedures must take into account of the needs of key participants.

According to Laufer at al. (1996), more and more project managers find the procedures applicable to any specific project, with minimal adaptations. The way these procedures are used depends mainly on the experience of the users. For young and new project managers, these procedures function as road maps to improve their efficiency and reliability. For experienced project managers, these procedures are only milestones to verify their course and act as checklists to ensure that no process is overlooked as a result of the pressure of time.

Hence it could be suggested that procedures for dealing with uncertainty in refurbishment must be flexible and should be structured for quick and timely

responses to be made. There is a need for flexibility but still within a structure that gives sufficient formalisation to create confidence. It is useful to set up contingency plans in the critical activities in the planning and control process so that the likely consequences and procedures can be reviewed.

Laufer et al (1994) suggested that a 'procedure matrix' which could be used in the planning and control process of construction projects. The procedure matrix is shown in figure 6.1

Figure 6.1 Proposed structure of planning matrix

Timing<sup>1</sup> - Pre-bid

- Pre-construction
- During-construction - Master, Mid-term, Short-term.

Plans	Engineering and method	Organisation and contract	Schedule	Cost and cash flow	Major equipment	Layout and logistics	Work methods	Manpower allocation	Materials allocation	Others <sup>5</sup>
Purposes			co-ordination, action plan <sup>2</sup>			co-ordination, action plan <sup>3</sup>		Forecasting, control <sup>4</sup>		
Users	GS, SC, FM					GS, SC		PM, GS, SC		
Time horizons			3 weeks			6 months		18 months		
Revision intervals			1 week			2 months		1 month		
Planning participants			GS, SC, PE, FM			GS, PE		GS, SC, PM, PE		
Modes of preparation			Proposal: SC+PE, approval meeting			Proposal: GS Processing: PE		Proposal: GS+SC Processing: PE		
Formats			Gantt, meeting protocols			Drawings, meeting, protocols		CPM, tables		

<sup>1</sup> Select one

<sup>2</sup> During construction, short term.

<sup>3</sup> Pre-construction

<sup>4</sup> During construction, Master.

<sup>5</sup> E.g. Safety, quality control, labour relation.

PM: project manager; GS: general superintendent; PE: project engineer; SC: subcontractors; FM: foreman

Source: Laufer et al. (1994) The multiplicity concept in construction project planning, Construction Management and Economics (1994), 11, 53-65, E & F.N Spon



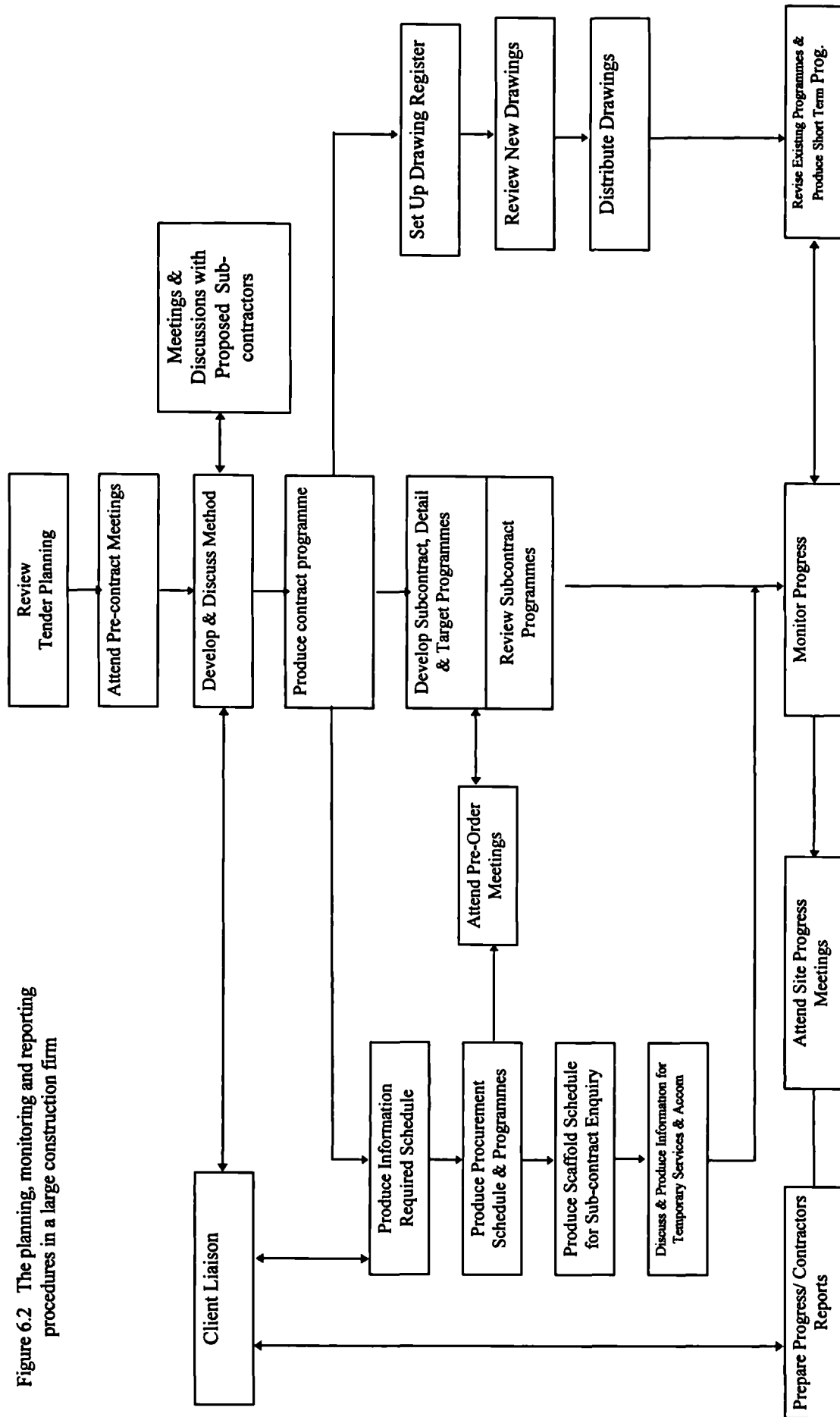
Close examination of the procedure matrix reveals that it is simple and leaves much room for discretion for the key participants. The detail for modes of preparation, for instance are left to the key participants. It specified only the users, time horizons, revision intervals, key participants and formats. It is most likely that the uncertainty of construction projects, changes will be required in the revision intervals and time horizons and to a lesser extent the involvement of the planning participants, but the general structure would still be applicable in any given situation.

The semi-structured interview conducted in this study reveals that the majority of the planning and control managers perceived that the planning and control procedures of their construction firms were fairly flexible. The archive examination conducted in this study on the Planning, Monitoring and Reporting Procedures used for a refurbishment project undertaken by a large construction firm confirms this result. The procedures are shown in figure 6.2.

Close examination of the procedures reveals that the flexibility in the procedure is served mainly by the inclusion of various meetings, review and revision activities in the procedure flow chart.

The procedures were established for efficient information flow between all parties directly or indirectly involved in the refurbishment project, for decision-making and feedback between designers, the construction team and the client. For instance, the activities of setting up a drawing register, review new drawings and distribute drawings are to handle changes in design to the work. By undertaking the activities, the changes could be notified immediately to all other personnel who might be affected. There are also four types of meetings incorporated in the planning and control procedures which could increase flexibility and information flow. They are pre-contract, pre-order, site progress meetings and discussions with proposed subcontractors. The meetings act as 'hinges', which facilitate adjustments that may be needed in the planning and control process of refurbishment projects.

Figure 6.2 The planning, monitoring and reporting procedures in a large construction firm



Source: A large construction firm - name withheld

Thus, it could be suggested that refurbishment project organisations must design planning and control procedures that are flexible and enough to cope with the nature of complexity and uncertainty of refurbishment projects.

However, 'flexible' procedures require greater discretion from the key participants. The more flexible the procedure, the greater the shift from management based on supervision to selection of responsible workers. Flexible procedures compel refurbishment project organisations to rely more on the management skills and knowledge of the key participants in planning and control. Flexible procedures make it less easy for the each key participant to detect the deviations made by others. Lack of communication skills and knowledge would slow down the feedback information in the planning and control process.

#### 6.5 The communication skills and knowledge of the key participants

Galbraith (1977) maintained that as the task uncertainty increases the volume of information that needs to be transmitted from the decision-makers to the implementers increases, which could overload the channels of communication. In such situations, it becomes more efficient for the implementers, who hold most of the required information, to make the decisions. This, in effect, tends to increase the amount of discretion exercised by the implementers, who are also the decision-makers.

Young et al (1996) concluded that refurbishment work is complex, involving decision-making within an uncertain environment. Refurbishment requires the ability to deal with processes that are continuous, complex and uncertain. This demands higher levels of management skills and knowledge than does new work. To maintain and effectively pass on the appropriate management skills, knowledge and competencies which refurbishment work demands, involves a structured approach to management, education and training of refurbishment personnel.

The skills and knowledge required in construction had been well research. Skills here is defined as the ability to perform a job (communicate) to a prescribed standard.

Knowledge is the received concepts, ideas, theories and school of thoughts (Constable, 1988). The most notable studies on skills and knowledge in construction were conducted by Young (1988), Finnigan et al (1987), Faulkner and Wearne (1979, 1984), CITB (1988) and Mustapha and Langford (1990). These studies show that interpersonal skills, i.e. communication, leadership, supervision and motivation are the most required or important skills and knowledge for construction management.

In Young (1988) study titled 'Career development in construction management', it was found that communication skills and knowledge to be the most required for construction management. In the domain of refurbishment management, the study conducted by Egbu's (1994) titled, 'Management Education and Training for Refurbishment Work Within the Construction Industry', communication skills and knowledge ranked second, after leadership, among the 75 job dimensions measured in his research. Egbu found that 97.3% of the 142 refurbishment managers surveyed perceived communication skills and knowledge (written and oral) to be important/very important in managing refurbishment projects. This percentage is only slightly lower than for leadership, which scored 99.3%.

Communication skills and knowledge are of significant importance in this study. Not only it is found to be the one of most important skills and knowledge required in refurbishment projects, but it is also an important co-ordination device for integration, which is the main theme of this study.

Egbu (1994) said that the importance of communication in refurbishment management is not only to transmit and co-ordinate but also to interpret and eliminate inaccuracies and to generate new ideas. Skill in communication is vitally important to increase the speed of response to address the issues arising from variations to the works. In refurbishment, with increase of contract labour, together with a corresponding increase in fragmented specialised work, and the difficulties associated with labour on site, the skills of communication become even more necessary.

The unique nature of the problems encountered in refurbishment projects means that managerial tasks are difficult to standardise. It has been discussed in chapter 5, that the

decisions that need to be made by the key participants in the process are interrelated. When there are many people who could make decisions, the problems related to controlling behaviour and conflicting decisions tend to increase. To reduce conflicts and to ensure the efficiency and effectiveness of information processing, the decision-makers need to consistently communicate their plan of action to other participants. Leavitt (1964) said that communication is a channel of influence aimed at changing personal and work relationships in order to accomplish organisational or personal goals.

The more complex and uncertain the projects, the greater the need to communicate, and the greater the tendency to suffer from information overload (Galbraith, 1977). To reduce information overload, organisations have to rely more on the communication skills and knowledge of their key participants.

Pilcher (1985) maintains that communication is an essential and the most important part of the management information process. The process of communication involves an interchange of thoughts, information, knowledge or opinions from one human brain to another. Communication provides information, which is the lifeblood of project organisations.

Bennett (1991) emphasises the importance of communication by linking it to planning and control. According to Bennett (1991: p. 293);

‘Control in modern organisations is the most effective when it is based on self-control by well motivated people who share a common vision in their joint objectives. Therefore managers in order to exercise control, must influence the values of those for whose work they are responsible. They do this by communicating’.

Laufer and Tucker (1988) in their study titled, ‘Competence and Timing Dilemma in Construction Planning’ maintains that planning and control managers must receive training in communication techniques, especially verbal ones.

Pietroforte (1997) maintains that in order to share the meaning of information, they must develop a considerable communication infrastructure, such as face-to face meetings.

The main concern here however, is that, the information in the planning and control process is presented in various forms such as oral, written, graphic and numeric documents. The clearest examples are drawings, specifications, calculations and schedules. In order to communicate effectively, the communication skills and knowledge required from the key participants go beyond written and oral skills.

The information needed to plan and control is widely dispersed among the key participants. The use of low-codified information such as drawings and charts is regarded as an effective way to communicate between key participants who have varying degrees of communication skills and knowledge. It is normally assumed that the key participants involved in the planning and control process are trained, or capable, of interpreting the drawings or schedules. Even though if these assumptions are found to be correct, the inherent fuzziness of drawings (Pentland and Williams, 1988) with their applications and format (Sanvido et al 1989) more congenial to the originator than the receiver, tends to lead to ambiguous interpretations. This implies that the extensive use of drawings in refurbishment projects means that, high graphic skills and knowledge are required from the managers involved in the planning and control process. The managers need to be conversant with the developments in graphic aids, equipment and reproduction methods. The diffusion of low-coded information, such as drawings, however, is generally slow. Drawings and charts take a long time to be produced and transmitted.

To accelerate the information flow, more highly-coded information needs to be used. The efficient use of computers, for instance, requires the information to be presented in highly coded forms such as in the forms of mathematical formula. The more codified the information, the more extensively it can be communicated (Boisot, 1986).

However, the more codified the information transmitted, the smaller the population competent to understand or interpret its meaning. According to Pietroforte (1997)

highly coded information is associated with a high degree of specialisation to process the information. A communication strategy based on the use of highly codified information would decrease communication costs and accelerate information transmission, but at the same time it would entail significant development, learning and training investment to increase the degree of communication skills and knowledge of the key participants. The returns for these investments need to be justified.

Increased uncertainty may compel refurbishment project organisations to use highly coded information, which facilitates frequent revisions to drawings and programmes. It implies that the key participants involved in the process must be able to understand project management computer software. In many other industries, such as manufacturing, the use of computer technology is generally accepted to be the natural solution to this problem. It provides fast accurate calculations and ease of scheduling, listing and drafting. Laufer and Tucker (1988) maintain that the use of knowledge-base systems from the computer technology provides easy interface between key participants, which tends to accelerate information flow.

The above discussions imply that the communication skills and knowledge expected from the key participants involved in the process need to be multifarious. The key participants have to ensure that people of different entities, different interests, experiences, cultural values and using different codes, terminology or language are able to understand the information that is being transmitted. (Hardcastle, 1990).

In order to communicate effectively in uncertain refurbishment projects, the key participants need to have skills and knowledge in the use of 'rich' and interactive media. The term 'richness' here means the complexity of language supported, the flexibility of format, the number of simultaneous channels of communication, and the degree to which the message is personalised (Daft and Lengel , 1986).

In the final postal questionnaire survey of the this study, the respondents were asked to rate the level of communication skills and knowledge of the key participants involved in planning and control of the refurbishment project. The result is shown in table 6.6.

**Table 6.6 The level of communication skills and knowledge of the key participants involved in the planning and control process of refurbishment projects**

Communication skills and knowledge	Refurbishment projects (N=67) %
Very low	0
Low	2
Neutral	15
High	43
Very high	40

Table 6.7 Shows that more than in 80% of the refurbishment projects, the communication skills and knowledge are high/very high.

This result is expected. Egbu (1994) established that communication skills and knowledge are one of the most important skills and knowledge required in refurbishment projects. Most certainly, many refurbishment project organisations placed greater emphasis on selecting key participants who had high level of communication skills and knowledge. The very high percentage (82.7%) of key participants with high/very high skills and knowledge is, however, surprisingly high. Most probably, the fact that the refurbishment projects were undertaken during recession, which normally associated with surplus of labour, enabling the majority of the refurbishment project organisations to secure key participants with high communication skills and knowledge. Besides, in Egbu's (1994) study, acknowledged earlier, it was found that only 55% of the 142 surveyed reported that communication skills and knowledge are difficult/very difficult. This implies that the skills and knowledge in communication are important, but relatively easy to acquire.

With the increasing use of information technology as a medium of communication in construction process, which requires a higher degree of information codification, a higher degree of investment in education and training in communication skills may become more necessary. Most likely, large construction firms, which tend to have training department, could provide in house training, thus enabling them to tackle this



problem better than small construction firms. The Spearman Correlation technique reveals significant correlation between the communication skills and knowledge of key participants and the size of construction firm (correlation coefficient 0.32 at 0.01 significant level). The smaller construction firms would have to rely on the educational institutions to provide the required skills and knowledge. Thus computer technology should form an important subject in construction management courses.

## 6.6 Information technology

Whereas control by involvement of key participants in decision-making may overcome many of the faults of an organisation's systems in smaller project, it is more difficult to achieve with larger projects. According to Bennett (1991), in such situations, teams undertaking construction projects are likely to need more information and decisions, and should seek to increase the information processing capacity of the project organisations.

Galbraith (1977), however, maintained that providing more information more often overloads the decision-makers. This is especially true in organisations undertaking complex and uncertain projects. There is a need for project information to be co-ordinated to ensure that essential project information is provided. Increasingly, this could be achieved with the use of information technology.

The review of literature revealed that numerous studies have been conducted in the applications of information technology in the construction industry. Information technology has been found to be beneficial in decision-making (Brandon et al 1980; Bon, 1988, Mohan, 1990), in cost control procedures (Arusi et al (1990) tendering and estimating (Teo et al 1991, Ahmad, 1990 and Dawood, 1995), project monitoring (McGartland and Hendericen, 1995) interpretation of data (Then, 1990, Westwood and Morris, 1990).

The use of information technology in planning and scheduling of construction projects has also been conducted, notably by Levitt et al (1988), Moselhi and Nicholas (1990),

Morad and Belivean (1991), Aouad and Price (1994) and Dawood (1995b). Charmer (1987) and Whiteman (1987) maintained that development of user friendly micro-based software for the critical path method of planning has expended the application of construction method techniques.

The numerous studies being conducted on the use information technology in construction reflects its importance as an information-processing tool for the construction processes. However, the tendency of researchers to focus their studies on narrow and specific project management applications such cost controlling, tendering and scheduling manifests a major concern, i.e. the use of computer in construction projects tends to be fragmented. This is largely due to the fact that the software applications have been designed largely as solutions to specific problems (BT and DoE, 1995). This in turn results in incompatibilities between separate systems. Fragmentation is also caused partly by organisational problems, such as when various parties involved have different objectives and priorities and do not wish to share data (Aouad and Price, 1994).

The potential of information technology to provide integration in the construction processes should not be overlooked. Young et al (1996) maintained that refurbishment work demands effective horizontal and vertical integration of inputs and decisions. The use of information technology would help to facilitate the integration of key participants in the planning and control process. Information technology could also help to facilitate the monitoring and control of the management of sub-systems of labour, materials, plant, finance and quality. In refurbishment, the need becomes even greater as the necessity for flexibility and speed of response increases, particularly where variation in work content is high, therefore supporting the use of software.

CIRIA (1994) pointed to a requirement for extremely detailed programmes and resources lists, with a level of detail in refurbishment projects, almost never found in new work. It requires refurbishment project organisations to allow fast reactive management responses by having sophisticated communication systems. CIRIA (1994) study reveals that construction managers interviewed concurred that computers should be used more in refurbishment than in new build for cost monitoring, as the

work tends to be bought in smaller packages. There is a lot more handling of numbers to be undertaken.

The capacity of information technology to facilitate integration would be limited if the information technology system used in the refurbishment project organisations is fragmented and the level of skills of the key participants in information technology is unevenly distributed. Improving the efficiency in one area of planning or one team without improving the others tends to produce a 'convoy effect' in which the overall efficiency is being determined by the slowest member in the refurbishment project organisation. If participation in decision-making is to be encouraged, computer literacy is essential for the planning and control managers.

During the semi-structured interview conducted in this study, a planning specialist employed in a medium sized construction firm said that the lack of skills of some site managers in computer technology resulted in the planning techniques produced by him not being regularly updated. The problem is made worse when the planning specialist had to be involved in more than one project at a time. Since, his involvement during the construction stage constitutes less than 30% of his work, his capacity to help the site managers to update the planning techniques is limited.

Three planning specialists employed in large construction firms however maintained that they were actively involved during the construction stage and worked in tandem with site management to update the planning techniques. One of the planning specialists said that the ability of most site managers employed in his construction firms to run the project management software reduced the need for him to be involved in monitoring of the progress of refurbishment projects.

Thus the effectiveness of the use of project management computer software as a tool for integration is very dependent upon manual intervention which implies that the skills of the refurbishment managers in information technology is vital. But the majority of refurbishment managers perceive that skills and knowledge in computer technology is difficult to learn. Egbu (1994) found that of 142 refurbishment managers surveyed in his study, 57% of construction managers participated in his

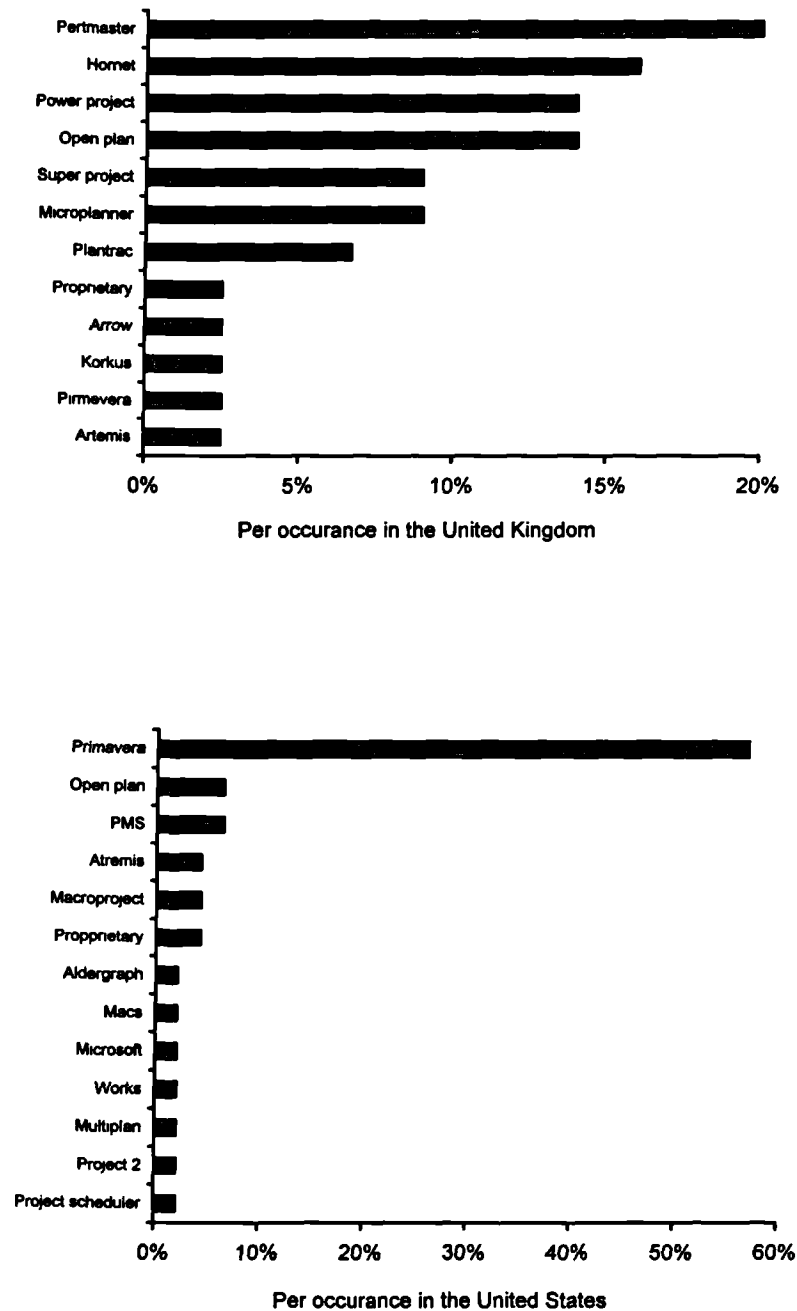
survey perceived that the use of computer technology to be very difficult/difficult and ranked 9th. Among the 75 job dimensions measured by him. Most certainly, the infrequent use of computer-based techniques in planning and control is associated with the difficulty faced by the refurbishment managers in acquiring the skills and knowledge of using them.

According to Tan (1996), the present information technology application in the construction industry is mainly in administration and accounting programmes, project management applications, two-dimensional CAD systems and three-dimensional CAD systems.

Among many information technology applications, the project management computer software is the most widely used in project planning in construction. Aouad and Price (1994) in their study titled, 'Construction planning and information technology in the UK and US construction industries: a comparative study', surveyed the top 100 contractors in the UK and the US. The response rate was 33% (33 replies) in the UK and 14% (14 replies) in the US.

Aouad and Price (1994) study found that 88% of the contractors in the UK used project management computer software in construction planning. The result is shown in figure 6.3.

Figure 6.3 Project management system used in the United Kingdom and the United States



Source: Aouad, G. And Price, D.F., *Construction Planning and information technology in the UK and US construction industries: a comparative study*, *Construction Management and Economics* (1994), 12, 97-106

Figure 6.3 reveals that Pertmaster, Hornet and Power Project are three of the most popular project management systems used in the UK. However, what is more interesting is that there is no one system is dominant. Pertmaster, the most popular system, constitutes less than a quarter of all the project management systems used.

In contrast, in the United States, the Primavera system strongly dominated the project management computer software applications. Thus there is greater standardisation and compatibility in the computer applications among different construction firms in the United States than in the United Kingdom. Greater compatibility of the system facilitates more efficient data exchange and therefore, greater information integration.

From the final postal questionnaire survey it was revealed that 76.6% of the refurbishment projects surveyed used the project management computer software in the planning and control process.

Table 6.7 The percentage of refurbishment projects used project management computer software in the planning and control process of refurbishment projects

	Refurbishment projects (N = 66) %
The project management computer software were not used	22.7%
The project management computer software was used	77.2%

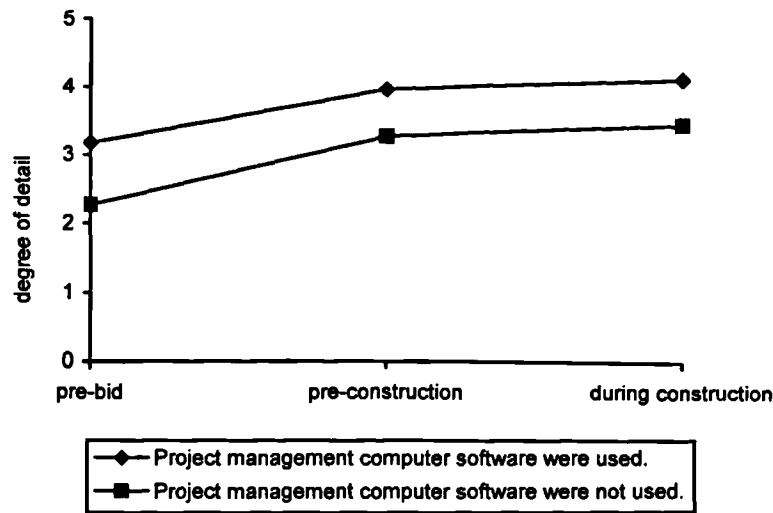
Table 6.7 shows that more than three-quarters of the refurbishment projects used project management computer software in the planning and control process of the refurbishment projects. This is slightly lower than in Aouad and Price's (1994) figure. This could be attributed to fact that unlike Aouad and Price's (1994) sample, which comprises the top 100 largest construction firms, the sample population of this study are large and medium construction firms in the South East of the UK, which tend to be smaller in size, and therefore less likely to use computers in refurbishment projects.

The result from the 15 semi-structured interviews conducted in the this study . In 13 out of 15 construction firms used project management computer software in the planning and control process of refurbishment projects. Most construction firms use more than one project management computer software. The most popular ones are the PowerProject professional and Hornet (in 5 construction firms) and the Pertmaster (in 3 construction firms). This project management computer software was mostly used to produce critical path analysis. The variety of computer software used reflects the high level of fragmentation of IT in the planning and control process could reduce the efficiency of data exchange and hence information integration among construction firms.

The use of project management computer software appears to increase the amount of information that could be processed to encourage the refurbishment project organisations to make early commitments. This is reflected in the degree of detail of the planning techniques.

Figure 6.4 compares the degree of detail of planning techniques between refurbishment projects using project management computer software and those that did not use it. The data was obtained from the final postal questionnaire survey (see appendix L). It was found that refurbishment projects that used project management computer software tended to produce more detailed planning techniques at the pre-bid, pre-construction and during construction than those who did not. The Kendall tau-b test reveal that differences in the degree of detail are significant (correlation coefficients of 0.31 during pre-bid, 0.31 during pre-construction and 0.26 during construction stage).

Figure 6.4 The degree of detail of the planning techniques used in the planning and control process



The increase in detail of planning techniques provides the key participants involved in the refurbishment projects with longer lead-time to prepare for the tasks to be executed on site and to co-ordinate their activities with the other key participants.

There are many other computer applications that could be of potential use in the planning and control process of refurbishment projects such as Computer Aided Design (CAD). These computer applications are even less widely used than the project management computer software. Aouad and Price (1994) discovered that only 30% of the construction firms surveyed were already using the system. The computer models such as expert systems and simulation techniques for construction planning purposes were used by 15% of the construction firms. Considering that the sample population is top 100 British construction firms, the percentage for the general population of the construction firms would be much lower. Since they are not extensively used in the construction industry in the UK, the potential benefits and problems could not yet be fully assessed.

Information technology is useful in establishing effective links between site and head office and between the main contractors with materials suppliers. This may be



beneficial for refurbishment projects with difficult access and confined space, which require materials to be delivered in small packages. This may enable the refurbishment project organisations to implement the concept of Just-in-Time (JIT) building materials management. A critical factor in the successful implementation of JIT for materials inventory and control on site is the direct link information system from site to suppliers via information system techniques such Electronic Data Interchange (EDI). However, the result from the semi-structured interview provides little evidence that this concept has been implemented.

Outside the field of construction, various studies have been conducted on the effect of man-machine interface on human integration. Connors et al (1994), in their study titled 'Crew systems: Integrating human and technical subsystems for the exploration of space'. Connors et al (1994) found that machines tend to shift the power from captains to first officer, based largely on the officer's greater proficiency of data entry.

Connors et al (1994) also found that the difficulty in co-ordinating the activities of individuals and teams who are working in separate locality. Connors et al (1994: p. 195) concluded that 'co-ordination of groups at different locations will becoming increasingly challenging and 'spacefarers' will not be able to rely on the ground but will be forced to operate with ever greater autonomy.'

Parallels could be drawn with the planning and control process refurbishment project. Site management and subcontractors are like 'spacefarers' and could not possibly rely on the planning specialist totally to plan site activities. They must have access to the computer and knowledge and skills to operate it. Their lack of skills and knowledge in computer technology will require greater communication with the head office, which may overload the communication channels. To be more effective, the site management must have a high level of skills and knowledge in computer technology and accompanied by direct link to the head office computers.

Thus information technology has great potential to function as a co-ordination device for the planning and control process of refurbishment projects. It can be used for exchange and integration of information, improve communication and decision-

making which could increase the information processing capacity. Many writers predict a high potential for information technology as a co-ordination device in construction project management in the future. Reinschmidt et al (1991), Gibson and Bell (1992), Heath et al (1994) and Mahoney and Tatum, (1994), for instance noted that the trends are clearly moving toward integration design and drafting systems among different disciplines and among different departments for material management. However, lack of skills and knowledge in computer technology of personnel involved in the construction industry may impede their potential use.

To summarise, all the co-ordination devices investigated in this study were extensively use in planning and control refurbishment projects. This reflects the high degree of complexity and uncertainty of refurbishment projects, which compel the refurbishment project organisations to allocate great amount of resources to increase the information processing capacity.

The low level of planning performance of refurbishment projects, especially in terms of cost variance and time variance, gives doubt to whether the resources had been used appropriately. The high extent to which the co-ordination devices were used in refurbishment projects, and yet accompanied with low planning performance, gives credence to the argument that the inherent complexity and uncertainty of refurbishment projects are difficult to resolve. There are reasons to believe that the complexity and uncertainty of the refurbishment projects reduces the capacity of the co-ordination devices to produce any significant effects on planning performance.

One of the main objectives of this chapter is to establish to what extent each co-ordination device could improve the planning performance of refurbishment projects.

#### 6.7 The associations between the co-ordination devices and refurbishment planning performance

Galbraith (1977) Harrison (1981), Lichtenberg (1986) and Mason (1984) maintained that a solution to which plans are worked out is a major determinant of construction

planning effectiveness. Galbraith (1977) for instance argued that increased use of co-ordination devices lead to improved communication within an organisation, which may lead to increased performance.

Table 6.8 shows the result of the Spearman correlation technique employed in this study to establish the influence of the co-ordination devices on the planning performance variables. The **negative** correlation coefficients indicate that increased use of co-ordination device increased planning performance.

Table 6.8 Associations between co-ordination devices and planning performance

Co-ordination devices	Cost variance	Time variance	Quality of workmanship	Monitoring <sup>1</sup>
Scheduled meetings	-.01	.00	-.31*	-.22
Unscheduled meetings	-.16	-.04	-.16.	-.06
Direct formal contact	-.06	+.09	+.08	-.14
Direct informal contact	-.06	-.08	-.22	-.39**
Planning and control procedures	-.09	-.33**	-.17	-.30**
Communication skills and knowledge	-.05	-.21	-.16	-.15
Project management computer software	-.09	-.03	+.03	-.24*

\* at 0.05 significant level \*\* at 0.01 significant level

<sup>1</sup> - the extent to which the planning techniques were used for monitoring during construction

The mainly negative correlations values shown in Table 6.8 support the hypothesis of this study that increase use of the co-ordination devices improves planning performance. It is heartening to note that, all planning performance variables, except cost variance, could be significantly improved by at least one of the co-ordination devices.

It should be pointed out that the majority of the co-ordination devices are significantly correlated to only one planning performance variable. This implies that the refurbishment project organisations need to increase the use of the co-ordination devices simultaneously in order to improve all areas of planning performance. Lack of

time and financial resources may compel the refurbishment project organisations to rationalise the use of the co-ordination devices in the planning and control process or prioritise the project objectives.

The lack of significant correlations between the co-ordination devices and cost variance is attributed to the following reasons. Firstly, as had been established in chapter 4 that the percentage of provisional sum to project contract value significantly affects cost variance. The amount of provisional sum is difficult to control as it is affected by the amount of services work and the changes made by the client during construction. Secondly, the involvement of the estimator in decision-making during construction stage is absolutely vital in reducing cost variance. This has been discussed in chapter 5. However, in the majority of the refurbishment projects, the estimator is not involved in decision-making during the construction stage. This implies that no matter what the levels of the co-ordination devices being used, their effectiveness to reduce cost variance would be minimal when the estimator is excluded in decision-making during the construction stage.

Table 6.8 reveals that time variance is significantly associated with planning and control procedures. This is not surprising since planning and control procedures enabled time deviations in the refurbishment projects to be detected and corrected more easily.

It has been argued that the use of planning and control procedures is more appropriate when the task to be executed could be planned in advance. Reducing uncertainty at an early stage by gathering more information would increase the potential for planning and control procedures in improving planning performance. The involvement of contractors during the design stage would facilitate more complete design information. The design and build procurement system gives better opportunity for the contractors to be involved during the design stage, and therefore a better option to be used in refurbishment projects in which time has a top priority. It has been shown in chapter 4 that in terms of time variance, design and build procurement systems performed better than traditional procurement systems.

Table 6.8 indicates that if the quality of the workmanship is the main priority, then more frequent scheduled meetings are necessary. Scheduled meetings increase flexibility in the project organisations and enable future actions to be documented and used as guidance for the implementers, especially the site management. Decisions could be made as needed. The quality of workmanship could be monitored more closely.

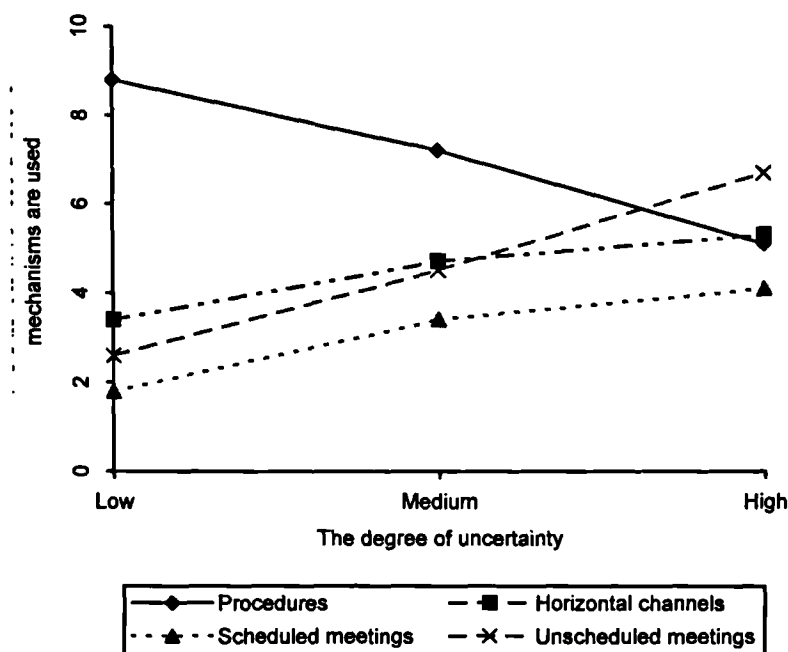
The extent to which the planning techniques are used for monitoring could be significantly improved by three co-ordination devices, i.e. direct informal contacts, procedures, and project management computer software. Refurbishment project organisation could choose one or all the three options. The use of planning and control procedures may require less investment, but only appropriate for routine tasks. With increased uncertainty, more flexibility is required which could be facilitated by the use of direct informal contacts. Further increase in uncertainty, such as increased project size, requires increased information-processing capacity, which may render these two co-ordination devices inadequate. The larger the refurbishment projects, the more likely for information overload to occur. They need to be supplemented with project management computer software.

The lack of significant correlations between the lateral relations and the planning performance variables are not totally unexpected. Lateral relations are the basic co-ordination devices, and had already been extensively used in the majority of the refurbishment projects. Further increase in use would increase the planning performance marginally. The potential of unscheduled meetings could be further exploited especially in refurbishment projects with difficult access to the site and when a large amount of design information is missing. This may not necessarily improve the planning performance as measured in this study, but may reduce conflicts between the occupants and/or client of the building and the contractors.

Galbraith (1977), Imbert (1987), Phatak (1983) and Van de Ven et al (1976) suggested that the use of the co-ordination devices should be adjusted to the nature of uncertainty of the environment in order to improve planning performance.

Van de Ven et al (1974) in their study, 'A task contingent model of work unit structure', measured the extent to which 197 personnel working in various departments in an organisation used the various co-ordination devices, including rules (procedures) under varying degrees of uncertainty. The results are shown graphically in figure 6.5.

Figure 6.5 Profile of co-ordination mechanisms on classified task uncertainty showing the extent to which co-ordination of mechanisms are used



Source: A.H.Van de Ven and A..Delbecq (1974). *A task contingent model of work unit structure*, *Administrative Science Quarterly*, (September), pp. 313-327

Figure 6.5 shows the use of rules (procedures) declines with increased uncertainty.

The Spearman correlation technique was used in this present study to establish the association between the situational variables and the co-ordination devices. The coefficients are shown in appendices R and S. The significant correlations shown in the appendices provide some evidence that the refurbishment project organisations tend to increase the use of the co-ordination devices with an increase in the

complexity and uncertainty of the situational variables. The most interesting results are listed below: -

- Increased project size is associated with an increase in extent to which planning and control procedures are used and increased levels of communication skills and knowledge.
- Decreased the state of completeness of design before work commences on site is associated with increased use of project management computer software.
- Decreased amount of space available on site for storing of materials is associated with increased levels of communication skills and knowledge.

It is interesting to note that the refurbishment project organisations appear to apply different co-ordination devices to respond to different situational variables. The larger the size of the project, the greater the sequential interdependency. Sequential interdependency is best handled by using planning and control procedures. Increased project size is also associated with increased reciprocal interdependency which requires increased communication skills and knowledge of the key participants.

The less complete the design information, the greater the reciprocal interdependency. Plans need to be revised and updated more frequently. The most efficient way to perform these tasks is by using project management computer software.

The more limited the space on site, the greater the reciprocal and pooled interdependency. The occupants/client, the contractor and the subcontractors all have to share the limited space. Friction is more likely to occur. This would be more easily avoided with increased communication skills and knowledge of the key participants.

However, it could be suggested that the interrelatedness of the situational variables might require refurbishment project organisations to employ a holistic approach rather than responding to a few situational variables.

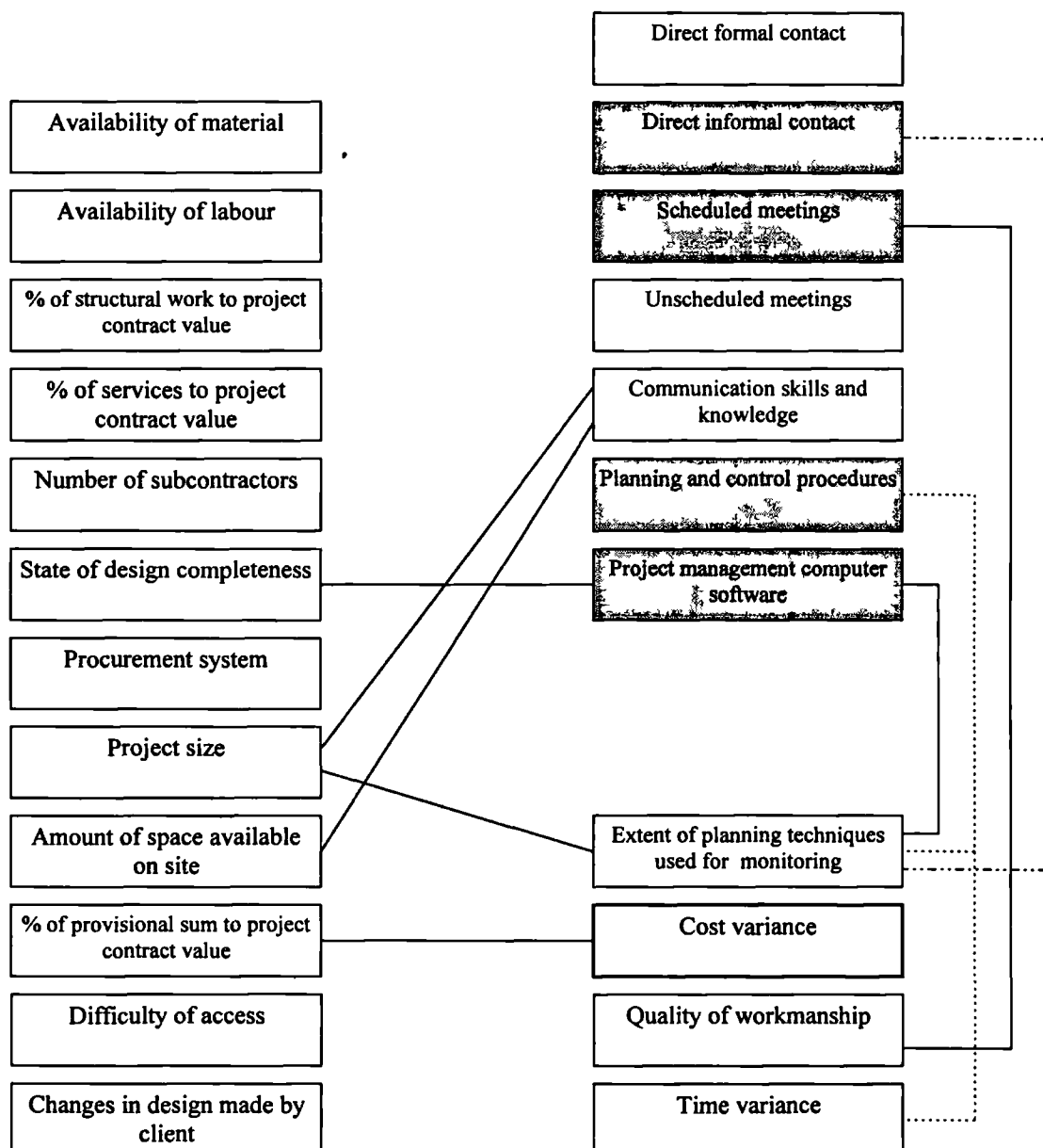
The results indicate that increase complexity and uncertainty of refurbishment projects require increase use of co-ordination devices, which also implies increase use of resources.

It is not the intention of this study to analyse in depth this aspect of planning and control of refurbishment projects. Further research is required in this area.

The results of the Spearman's correlation technique conducted in this chapter are summarised in figure 6.6.



Figure 6.6 Inter-relationships between situational variables, co-ordination devices and planning performance



Each box in figure 6.6 represents a variable. The shaded boxes represent the co-ordination devices that are significantly associated with planning performance. When two variables are significantly correlated, they are linked by a line. The figure could be used by refurbishment project organisations as a guide to find the right balance between planning performance, resources available in the organisation and the complexity and uncertainty of situational variables. For instance, to reduce time variance, require greater use of planning and control procedures. With increase project size, the more planning and control procedures need to be used.

It could be argued that the extent to which the co-ordination devices are used in the planning and control process is determined by the resources available in the refurbishment project organisations. The efficient use of resources, together with the effectiveness of refurbishment projects are two major concerns of many refurbishment projects. Limited resources may compel refurbishment project organisations to accept lower planning performance.

It could also be suggested, that the extent to which the co-ordination devices are used in the refurbishment projects is influenced by the organisation structure of the construction firms undertaking refurbishment projects. The need to increase efficiency within the construction firm may deprive the refurbishment project organisations from employing the appropriate co-ordination device that refurbishment projects require.

Thus the influence of the construction firms on the use of the co-ordination devices in the planning and control process of refurbishment projects needs to be established. This will be covered in chapter 7.

## 6.8 Summary and recommendations

This chapter presents theory and research for the co-ordination devices used in the planning and control process of refurbishment projects. Data from the final postal questionnaire survey was analysed in conjunction with qualitative and archive examinations. The purpose is to establish the co-ordination devices used in the planning

and control process of refurbishment projects and their associations with planning performance. The conclusions are summarised below: -

- Direct formal contact is an important method of obtaining information in the planning and control process in the majority of refurbishment projects and functions as an important co-ordination device. Contractual obligations and lack of trust between clients and contractors appear to play a major role in its use which leads to increased formalisation of the planning and control process.
- Refurbishment projects requires an informal culture. Close relationship and teamwork are important in the planning and control process. This is reflected in the fact that in the majority of the refurbishment projects, direct informal contact was found to be a very important method of obtaining information. Therefore, it is important that the decision-makers involved in the planning and control process be located close to each other to facilitate direct informal contact.
- Meetings, both scheduled and unscheduled are important co-ordination devices in the planning and control process. The interrelatedness of decisions require frequent meetings to take place. The statistical technique shows that increased use of scheduled meetings is associated with increased quality of workmanship. To ensure the effectiveness of meetings as co-ordination devices requires the key participants to gather, update and document information regularly and systematically.
- The planning and control procedures were extensively used in most refurbishment projects. Statistical technique led to the conclusion that planning and control procedures significantly reduce time variance and increase the extent of the planning techniques being used for monitoring. The uncertainty of refurbishment projects requires the planning and control procedures to be flexible. The design of planning and control procedures should involve the site manager. A 'procedure matrix' which specified the users of the plans, the time horizons and the revision intervals should be produced in the planning and control process of refurbishment projects.

- It is important for the key participants involved in the planning and control process of refurbishment projects to have multifarious communication skills and knowledge. The key participants need to use rich and integrative media. High skills and knowledge in information technology is needed.
- Project management computer software is widely used in the planning and control process of refurbishment projects. The statistical technique shows that using project management computer software enables the planning techniques to be produced in greater detail at all three refurbishment project stages. The extent to which the planning techniques are used for monitoring is greater when project management computer software is used.
- This chapter recommends that further research should be conducted on the effects of the situational variables on the extent of the co-ordination devices that are used in refurbishment projects.

## **Chapter 7**

### **The construction firms and the planning and control process**

#### **7.0 Introduction**

Chapter 5 and 6 provide evidence that the extent to which the integrative mechanisms used in the planning and control process of refurbishment projects influence the planning performance. The integrative mechanisms are used to provide flexibility and improve the information processing capacity. Bresnan (1990) in his study 'Organising construction: matrix organisation', however maintains that the more the construction project requires a flexible form of organisation, the less likely it is to get it. One reason for this is the conflicts between the needs of the firm and the needs of the project. Bresnan (1990: p. 2) said;

'Project organisations commonly face something of a dilemma. On the one hand, there is a need to devise a structure that directs activity towards the achievement of specific, but non-recurring, objectives. On the other hand, this structure should allow for the maintenance and development of functional specialisation. In other words, they need to be oriented towards both projects and functions.'

The estimator, planning specialist, contracts management and site management and to a smaller extent, the subcontractors, have to operate concurrently within the temporary refurbishment project structure and the more permanent construction firms' structure. Rules and procedures established by the construction firms tend to influence their activities in the process. The attempt to achieve a flexible refurbishment project structure may be hindered by the unwillingness of the construction firms to make the necessary adjustments to the needs of the refurbishment projects. Walker (1989) said that the temporary nature of the project organisation provides few opportunities for the construction firms to get use to each other at both corporate and individual levels, which hinders the setting up of the appropriate organisation structure for the

construction projects. The temporary nature of construction projects may discourage them from investing much time and money in making construction process more effective. This results in some construction firms employing the established standard procedures that are inappropriate for an individual construction project.

This view is supported by Faniran et al (1994) and Tucker (1986) who maintain that the organisation structure of the construction firms acts as a moderator to the efforts placed on planning.

It is important that a balance be found between the interest of the construction firms and the interest of the refurbishment projects. The interest of the construction firms is served by the organisation structure of the construction firms and the interest of the refurbishment projects is served by the integrative mechanisms employed in the refurbishment projects.

Therefore, it is imperative to investigate the effects of the construction firms' organisation structure on the integrative mechanisms used in the refurbishment projects. Winch (1989: p. 331) argued for the importance of studying the firm, as well as projects by stating that, 'while the effective management of construction project is of central interest to us all, the aim depends first upon the effective management of the firms which contribute to that project. The project is a temporary organisation, while the firm has a continuing capacity to create the built environment'.

The objectives of this chapter are:

1. To establish the organisation structure of the construction firms undertaking refurbishment projects.
2. To establish the associations between the organisation structure of the construction firms and the extent to which the integrative mechanisms are used in the planning and control process of refurbishment projects.

3. To establish the relationship between the organisation structure of the construction firms and planning performance.

### 7.1 The organisation structure of the construction firms

The review of literature reveals that there are extensive studies on organisation. Among the major studies were those conducted by Woodward (1965), Burns and Stalker (1961), Lawrence and Lorsch (1967), Blau et al (1967), Pugh et al (1969), Child (1972) and Galbraith (1977). Organisation research in construction, however, is rather sparse (Lansley, 1994). Probably, only the studies conducted by the Tavistock Institute (1969) and to a lesser extent by Aston Group (1969), Birch and Williams (1968), Sozen (1985) and Bresnan (1988) are the best known. However, the majority of these organisational studies are relating to the influence of technology and the environment on the organisation structure.

There are six different models and theories of the ways organisations could be analysed. They are the organisation structure, management style, problem-solving skills, transaction cost, codification-diffusion theory and cultural theory. The organisation structure, management style and problem solving skills are seen from the perspective of conventional organisation theory put forward by Burns and Stalker (1961), Lawrence and Lorsch (1967) and Galbraith (1973). Whereas transaction cost, proposed by Williamson (1975) and codification-diffusion, put forward by Boisot (1987) and cultural theories are more recent, only emerging in mid 1970s.

Lansley (1994) said that despite the wide range of models and theories of analysing organisation, there are strong links between each model. It is possible to show that despite their different perspectives and objectives, the models and theories can be reconciled and harmonised since their characteristics are parallel to each other. For any dimensions in one model, there is an equivalent in another. The presence of common characteristics between the models and theories helps to provide a convergence point for those who have studied organisations from different perspectives.

For practical reason, in the context of this thesis, the author considers that it is sufficient to analyse the organisation of the construction firms from one perspective only. This would avoid the repetitions of explaining similar ideas present in each model. For this study, a conventional model, organisation structure, was chosen. The organisation structure stipulates how tasks are to be allocated, who reports to whom, formal co-ordination devices and which interaction patterns will be followed (Hall, 1972).

It is not the intention of this chapter to examine the factors that contribute to the differences in the organisation structure of the construction firms, since the subject has already been well documented in the references given in this study. The main emphasis of this chapter is to examine how the differences in the organisation structure affects the planning and control process of refurbishment projects and the planning performance.

Lansley (1994:p. 346) provided two main advantages of the organisation structure, a conventional model:

1. It provides a straightforward approach to analysing, describing and characterising an organisation. The insights that a conventional model provides tend to be focused on operational issues, the elements that contribute to success.

Since the present study is concerned with refurbishment project planning and control, therefore deals mainly with short-term and operational issues, the organisation structure model was considered to be the most appropriate for analysing the organisational characteristics of the construction firms.

2. It is more useful in determining the organisation requirements of the construction firms.

Even within organisation structure, different models have been presented by various organisational writers such as Burns and Stalker (1961), Sadler and Barry (1970), Handy (1976), Mintzberg (1983), Galbraith (1973), Keidal (1984), Hall (1972) and



Lansley et al (1974). Though the dimensions are presented under different labels, they explain similar organisation characteristics.

The conventional model has three dimensions; i.e. complexity, formalisation and centralisation. In this study, the three components of organisation structure of the main contractor firms are measured. The influence of the organisation structure on the extent to which the integrative mechanisms were used in refurbishment projects is discussed below.

## 7.2 The complexity of the construction firms

Many construction firms start as one or two-man operations carrying out small construction works and limited in scope (Birrell and Jouini, 1984). The production methods are based on craft work and do not rely on heavy mechanisation. The firm is informally organised. Rules and norms of behaviour are not standardised. There is no sharp distinction between functions. The organisation, therefore, is essentially centralised. Under these conditions, a craft administration seems to be a more efficient form of administration for construction firms than a bureaucratic form (Stinchcombe, 1959).

According to Lawrence and Lorsch (1967), organisations are created to solve environmental problems. Organisations develop separate units for example, departments and divisions; functions then become more complex in order to deal with various aspects of environment.

As the construction firms become larger and use more advanced technology, a greater degree of interaction between the people in the organisation is generated. This leads to greater complexity of tasks, which in turn leads to the creation of additional departments or divisions. The additional new departments helped by economies of scale tend to increase the complexity of the organisation structure (Dewar and Hage, 1978).

Pugh et al (1969) and Sozen (1985) measured the complexity of construction firms by listing 36 activities. The list of activities used by Sozen (1985) was based on the studies conducted by Pugh et al (1969). Pugh et al (1969) asked the respondents in their surveys whether there was 'at least one person in the firm responsible for the particular activity' listed. This dimension intends to show the clarity of role definition within the organisation.

From thorough examination of the activities listed by Pugh et al (1969), the author discovered that the activities (among others, tendering, transport, employment and accounts) are all typical activities in any construction firm.

The author considered that Pugh et al's (1969) use of the phrase '*at least one person*' leads to two potential problems. Firstly, since the activities listed are typical activities, there would be a greater chance that at least one person in a construction firm would be carrying out all those activities. Hence, the respondents would be more likely to tick 'yes' to all of the listed activities. The implication would be that all the construction firms would show a similar degree of complexity in the organisation structure.

The second problem is that it is highly probable that one person in a construction firm is responsible for more than one of the activities listed. In fact, in smaller firms, it would not be unusual to find that some of the 36 activities are being carried out by only one or two persons. The result obtained could prove to be misleading. The author would not be able to differentiate whether each activity is being carried out by a separate individual, or whether one individual carrying out all 36 activities. In the first case, the activities in the construction firms are highly differentiated and therefore the organisation structure is more complex. By contrast, in the second case, the activities are not differentiated at all and the organisation structure is simple, as in the case of a sole proprietor.

Lansley (1994) criticised the methods used by Pugh et al (1969) as confusing, because it involves too many factors and too many dimensions. The author would like to add that the wording used by Pugh et al (1969) is ambiguous.

In this study, the complexity of the construction firms was measured by asking each respondent in the final postal questionnaire survey to indicate which of the 23 departments or divisions listed in the final postal questionnaire survey did his construction firm have, when the refurbishment project was carried out. The listed departments are shown in Appendix L.

It could be argued that each department or division in the construction firms was created because of the need for specialisation. The more departments/divisions created by a construction firm, the more complex would be the organisation structure of the firm.

It should be noted here that 54 construction firms participated in the final postal questionnaire survey. Thirteen of these construction firms returned 2 useful questionnaires enabling this study to obtain 67 cases or projects. To avoid double counting, only one case per construction firm is included in the analysis for this chapter. The cases chosen for analysis are those which are more comprehensively answered.

All the fifty-four construction firms participating in the final postal questionnaire survey were analysed. The construction firms were classified under three different categories of complexity, i.e. simple, intermediate and complex. The construction firms with less than 10 departments are categorised simple, 11 - 14 departments are categorised as intermediate and more than 15 departments are categorised as complex. The percentage of the construction firms in each category is shown in table 7.1.

Table 7.1 The complexity of construction firms

No of departments/ divisions.	Construction firms (N=54)%
Less than 10 (simple)	31.5
11 to 14 (intermediate)	42.6
More than 15 (complex)	25.9

Table 7.1 reveals that the complexity of the construction firms undertaking refurbishment projects are varied. Slightly more than a quarter of the construction firms have more than 15 departments. Almost 70% have more than 10 departments. This result indicates that there is a tendency to specialise activities in the construction firms. It must be pointed here that the construction firms participated in this study were those undertaking refurbishment projects of contract value more than £500,000 and the construction firms would tend to be larger and more complex.

The present study measured the size of the construction firms in terms of the average annual turnover between 1992-1994. The result is shown in table 7.2.

Table 7.2 The size of construction firms: based on average annual turnover for a period between 1992-1994

Size	Construction firms (N=54) %
Medium (£1 to £10 mill)	29.6
Large (£11 to £100 mill)	53.7
Very large (more than £100 mill)	16.7

Table 7.2 reveals that the size of the construction firms carrying out refurbishment projects is varied, ranging from less than 10 million pounds per annum to more than 100 million pounds per annum. More than 70% of the construction firms carrying out the refurbishment projects are large/very large. The high percentage of large/very large construction firms undertaking refurbishment projects reflects the growing importance of the refurbishment sector to large construction firms.

By employing the Spearman's correlation technique, this study found that the complexity of the organisation structure was significantly associated with the size of the construction firms (correlation coefficient .48 at 0.01 significant level). This provides the evidence of the validity of the data obtained from the final postal questionnaire survey of this study.

According to Quah (1992) the entry of larger-sized construction firms into the refurbishment market should bring better management expertise into a traditionally less organised sector of building work. It creates greater competition, especially in smaller-sized refurbishment projects, whereby the smaller construction firms have to compete with the larger ones. This phenomenon does not occur in competition for new build work as contractors, in the main, concentrate in tendering for projects within a defined size range; i.e. large contractors do not normally compete for small-sized projects.

The data obtained from the preliminary postal questionnaire survey only partly supports Quah's (1992) statement. From the 103 construction firms responding to the preliminary questionnaire, 42 were classified as medium (annual turnover £1-10 million), 42 as large (annual turnover £11-£100 million) and 12 as very large (annual turnover of more than £100 million). The respondents were asked to indicate the size of refurbishment projects undertaken by their construction firms. The size of the refurbishment projects were classified into small (£20,000 to £100,000), medium (£101,000 - £1,000,000) and large (more than £1,000,000). For the exact wording and measurement are shown in appendix F. The result is shown in figure 7.1.

Figure 7.1 The percentage of medium, large and very large construction firms undertaking small, medium and large refurbishment projects

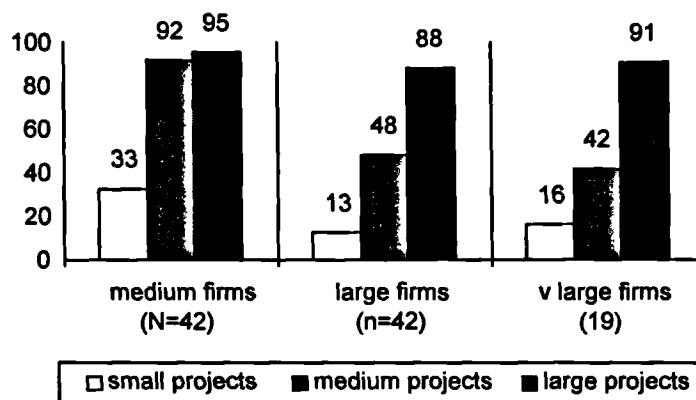


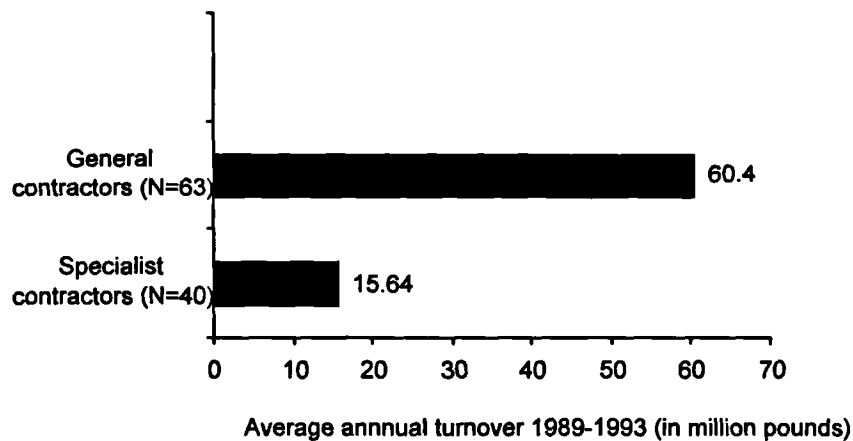
Figure 7.1 reveals that 13% of large construction firms and 16% of very large construction firms undertake small refurbishment projects. In fact, nearly half of these construction firms undertake medium refurbishment projects. However, figure 7.1 also reveals that larger construction firms tend to undertake larger refurbishment projects.

The above result implies that even though there are large/very large construction firms undertaking small refurbishment projects, the numbers are quite small. Besides, it should be pointed out that the preliminary postal questionnaire survey was conducted in 1994, during recession time. The shortage of work might compel the large construction firms to undertake small refurbishment projects. Hence, the degree of competition in small refurbishment projects could be attributed to market conditions, above everything else. During a boom period, there would be a greater tendency for the construction firms to undertake work within a defined range.

The entry of large construction firms in small refurbishment projects would force smaller construction firms to be more competitive. The tendency for smaller construction firms to specialise in refurbishment projects most certainly reflects their long-term strategy to be more efficient and effective. The data obtained from the preliminary postal questionnaire survey shows that smaller construction firms tend to be specialist refurbishment contractors.

From the preliminary postal questionnaire survey, of the 103 construction firms that responded, 40 were classified as refurbishment specialist contractors and 63 general contractors. The specialist contractor is defined as a construction firm of which more than 50% of its turnover between the year 1989 to 1993 is derived from refurbishment projects. The general contractor is defined as the construction firm of which 50% or less of its turnover over between the 1989 to 1993 is derived from refurbishment projects. The result from the survey, shown in figure 7.2. reveals that on average, the annual turnover of the specialist contractors is much smaller than the general contractors.

Figure 7.2 The average annual turnover of the specialists and general contractors undertaking the refurbishment projects for the period between 1989- 1993



It could be argued that the larger construction firms, which tend to be more complex and non-specialised would be at a disadvantage, especially when competing in smaller refurbishment projects. The large/very large construction firms must be flexible in order to have comparative advantage. It is interesting to examine how the flexibility in refurbishment projects is provided by complex construction firms. Flexibility could be achieved by higher use of integrative mechanisms in the planning and control process. The Spearman's correlation technique was used to establish the relationship between the complexity of construction firms and the involvement of the key participants in decision-making in the planning and control process. The results are shown in table 7.3.

**Table 7.3 Construction firms and the involvement of the key participants in decision-making in the planning and control process of refurbishment projects**

Key participants	Pre-bid	Pre-construction	During construction
Estimator	-.06	-.04	-.03
Planning specialist	.40*	.31*	.38*
Contract management	.09	.02	-.15
Site management	.23	.24	.05
Subcontractors	.36**	.32*	.11
* at 0.05 significant level      ** at 0.01 significant level			

Table 7.3 shows that increased complexity of construction firms is associated with an increase in involvement of the planning specialists in decision-making at all three refurbishment project stages. This implies that the planning specialist has to play a more significant integrating role in complex construction firms. The planning specialist, as has been established in chapter 5 is an integrator, who function as a 'linking pin' to the other key participants.

Likert (1967) said that increase complexity of organisation structure, in turn, makes effective co-ordination more necessary and more difficult. He suggests that one mechanism for achieving co-ordination and integration is by having people serve as 'linking pins' between various units in the organisation. Horizontally, there are certain organisational participants who are members of the two separate groups and serve as co-ordinating agents between them. On the vertical basis, individuals serve as linking pins between their own level and those above and below.

In general, this result confirms a number of expectations. Firstly, the greater the task complexity and uncertainty, the greater input needed from specialist expertise into problem-solving and decision-making processes. Secondly, that task complexity and uncertainty require a more organic, more flexible and participative structures of interaction.



The greater involvement needed from the planning specialists in complex construction firms could be attributed to having to cope, not only with the complexity of the refurbishment projects, but also with the complexity of the organisation structure. Increased complexity of construction firms indicates increased specialisation of functions. Increased specialisation tends to increase the degree of dispersion of the information needed to plan and control among the various departments. The greater the dispersion of information, the higher the need for an integrator. This implies that the more complex the construction firms, the greater the resources needed to be employed in the planning and control process of refurbishment projects.

The higher involvement of planning specialist in decision-making in complex construction firms reflects the emphasis placed by them on scheduling. According to Laufer et al (1996) scheduling concentrates on the co-ordination of sequential and parallel activities and control of performance, backed by information technology. From the Spearman correlation technique, it was found that the use of computers was significantly correlated with the complexity of organisation structure (correlation coefficient of .36 at 0.01 significant level) and construction firm size (correlation coefficient of .60 at 0.01 significant level). This results further support the arguments that the higher the degree of complexity of the construction firms, the greater the emphasis being placed upon supervision and controlling.

This result also confirms Bresnan's (1988) observation that greater task complexity and uncertainty require a corresponding input of specialist expertise and information into problem-solving and decision-making processes. It also supports Kabaskal et al's (1989) finding that the greater use of management systems, which is reflected in the greater number of specialists employed, is associated with a higher level of internal differentiation in the construction firms.

It appears that complex construction firms did attempt to ensure a more flexible, responsive and adaptive approach to planning and control. These firms also tend to move towards a more organic form of work unit structure in conditions of task uncertainty. Thus, Walker's (1989) argument that the tendency of the construction firms not to be willing to adjust to the individual needs of construction projects

because of the limits imposed by the organisation structure of the construction firms, could be called into question.

It is highly probable that the more complex the construction firms, the greater tendency to adopt a more participative management style. The participative management style would expect increased involvement of the key participants especially the subcontractors, whose involvement in decision-making during pre-bid and pre-construction is low. The information needed for planning and control in the complex construction firms tends to be more dispersed. There is a greater need to increase the efficiency of communication between departments, which requires greater involvement of all key participants involved in the projects. This is especially true during the pre-construction stage which is a mobilisation stage, when long-term planning is at its most intense.

Significant positive associations between the complexity of construction firms and the involvement of the subcontractors in decision-making during the pre-bid and pre-construction stages could be partly attributed to the fact that complex construction firms tend to employ more subcontractors. The Spearman's correlation technique found that increased complexity of construction firms is associated with the increased number of subcontractors employed in refurbishment projects (correlation coefficient of .31 at 0.05 significant level). The higher number of subcontractors employed in refurbishment projects implies a higher proportion of information in planning and control is held by them. Higher involvement of subcontractors in decision-making during the pre-bid stage is therefore vital, especially in gathering and analysing cost estimates for the purpose of bidding.

The Spearman's correlation technique was also used to establish the relationship between the complexity of the organisation structure of the construction firm and the co-ordination devices used in the planning and control process of refurbishment projects. The result is shown in table 7.4.

Table 7.4 The correlations between the complexity of the construction firms and the co-ordination devices

Co-ordination devices	Complexity
Regular scheduled meeting	.30*
Special meeting	.08
Direct formal contact	-.02
Direct informal contact	.43**
Construction firms' planning and control procedures	.51**
Communication skills and knowledge	0.21
Project management computer software	0.47**

\* 0.05 significant level      \*\*\* 0.01 significant level

Table 7.4 shows that the complexity of the construction firms is significantly associated with four co-ordination devices. These results provide further evidence that complex construction firms did attempt to provide greater integration in the planning and control process of refurbishment projects. The results are discussed in turn below.

The information required for planning and control in complex construction firms tends to be more dispersed among the personnel located in various departments. There is a greater need for the information to be co-ordinated. In such situations, horizontal integration, through meetings, is important to provide efficient flow of information between different departments. This demands complex construction firms to hold more scheduled meetings.

Most would agree that regular scheduled meetings alone would not be sufficient to provide all the necessary information in the planning and control process. Unexpected changes, which need prompt decisions frequently occur during the execution of the refurbishment projects. The combined effects of the uncertainty of the refurbishment projects and the higher degree of complexity of the construction firms require increased direct informal contacts among the participants involved in the planning and control process.

Table 7.4 reveals that the more complex the construction firms, the more extensive the extent to which the planning and control procedures were used. This result was anticipated. The problem of co-ordination in complex construction firms tends to be higher because of higher differentiation of tasks. More people need to be involved from various departments. To avoid conflicts between the different departments and to provide efficient supervision and control, the key participants are required to use and follow the standard planning and control procedures.

Table 7.4 also show that increased complexity is associated with increased use of project management computer software. The more complex the construction firms, the more resources available, thus, the more likely to employ planning specialists and to invest in information technology. They also tend to undertake more complex construction projects, which necessitate the use of project management computer software to increase information processing capacity.

Oddly, Faniran et al (1994) discovered that increased complexity (specialisation in construction firms) decreased the extent to which emphasis was placed on project control. The degree of involvement of the planning specialist in decision-making during construction reflects the emphasis on project control. The finding of this study, however, has shown that increased complexity is associated with increased involvement of planning specialists in decision-making. Thus, Faniran et al's (1994) finding contradict the result of this study. Unfortunately, Faniran et al (1994: p. 495) interpreted their result rather confusingly; 'if it is assumed that the use of specialists for construction planning increases with increased specialisation in the organisation structure then this result contrasts with the views previously expressed by researchers in construction planning that specialist planners focus their planning efforts mainly on scheduling and project control', (*sic*). Most probably, Faniran et al's (1994) correlation is spurious, due to the fact that only 25 cases were analysed in their study.

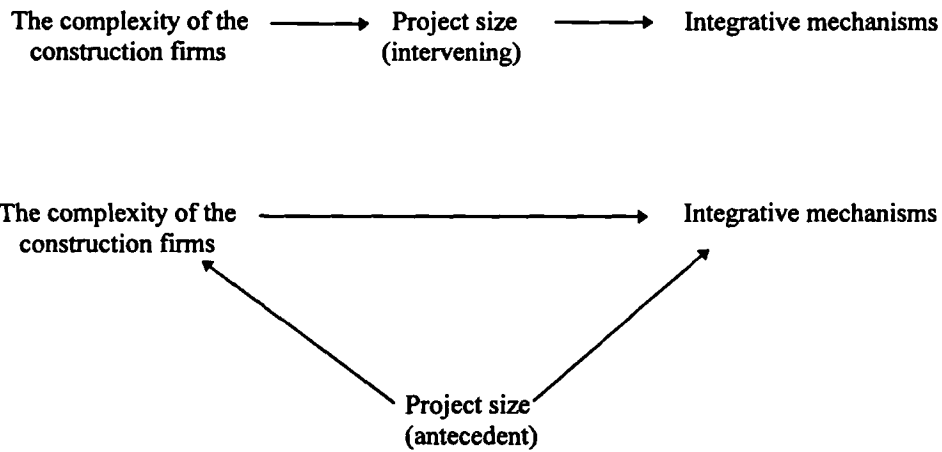
The results in tables 7.3 and 7.4 both indicate that the complex construction firms tend to use more resources in the planning and control process than the simple construction firms. Therefore, it could be suggested that the complex construction firms are less efficient than the simple construction firms. There is a convincing explanation to this.

Galbraith (1977) maintained that uncertainty is not only derived from the insufficient information to perform a task. It could also be derived from the complexity of the organisation structure. According to Galbraith (1977), more information is needed to be processed in complex organisations where more people are involved in performing a task than in a simple organisation.

Thus, in complex construction firms, the uncertainty derived from the refurbishment projects is compounded by the uncertainty derived from the complexity of the construction firms. The resources used in the complex construction were not fully directed to the refurbishment projects, but some were diverted to tackle the complexity of the organisation structure of the construction firms. Any improvements that could be achieved from the use of a higher degree of co-ordination devices in the complex construction firms tend to be absorbed by the need of a greater integration, caused by the complexity of the organisation structure. In this context, it could be said that the complex construction firms tend to be less efficient.

However, it should not be overlooked that the complex construction firms tend to undertake larger refurbishment projects. Thus, it could be argued that the larger refurbishment projects require greater integrative mechanisms. There are strong reasons to believe that, for smaller refurbishment projects, the complex construction firms would adapt, and use less of the integrative mechanisms, hence, less resources.

Partial correlation technique could be used to test this proposition. With this technique, it is possible to determine to what extent the relation between the independent variable (the complexity of the construction firm) and the dependent (the integrative mechanisms) variables is in fact caused by a third (contingency) variable, the project size. In this case, the refurbishment project creates 'spurious' correlation between the complexity of the construction firms and the integrative mechanisms either by intervening or as antecedent variable as shown in the following diagrams:-



This study will now determine more systematically whether the relations found between the complexity of the construction firms and the integrative mechanisms coefficients remain at their original level if the refurbishment project size is controlled, or whether they show significant decreases. The results of the partial correlation technique are shown in table 7.5 and 7.6.

Table 7.5 Partial correlations between the complexity of the construction firms and the degree of involvement of the key participants in decision-making, with *control* for project size

Key participants	Pre-bid	Pre-construction	During-construction
Estimator	-.08	-.04	-.16
Planning specialist	.45**	.28	.26
Contract management	-.05	.09	-.20
Site management	-.09	.13	-.13
Subcontractors	.27	.22	-.05

\* at 0.05 significant level \*\* at 0.01 significant level

Table 7.6 Partial correlation between the complexity of construction firms and the co-ordination devices *controlling* project size

Co-ordination devices	Complexity
Regular scheduled meeting	.37**
Unscheduled meeting	.02
Direct formal contact	-.02
Direct informal contact	.44**
Planning and control procedures	.45**
Skill and knowledge	.20
Project management computer software	.45**

\* at 0.05 significant level \*\* at 0.01 significant level

Close examination of the coefficients in table 7.5 reveals that the coefficients are not significantly different from the coefficients in 7.3. Likewise, the coefficients in table 7.6 are not significantly different from the coefficients in table 7.4. It could be concluded that the project size has no significant effect of the relation between the complexity of the construction firms and the levels of the integrative mechanisms used in the planning and control process. It means that, at any project size, the more complex the construction firms, the more likely they are to use a higher degree of the integrative mechanisms and hence, use more resources.

It is suggested that in order for complex construction firms to compete with simple ones, the complex construction firms should create a self-contained refurbishment department or a subsidiary to handle refurbishment projects. The smaller refurbishment subsidiary company should have full autonomy. The effects of formalisation and complexity of the parent company on the operations of the refurbishment projects could be reduced.

### 7.3 The Formalisation of organisation structure of the construction firms

Increasing size, technological advancement and complexity of organisation structure, create a greater need for co-ordination and control between different departments or functions. On the one hand, this is due to increasing specialisation, which causes problems of division of labour. On the other hand, increasing size creates problems of allocation as staff and equipment are spread over a number of jobs (Stone, 1966). The organisation responds by turning to formalisation.

The indicator of formalisation is the presence of written job descriptions (scope of work). The main aims of formalisation are to reduce variability, increase consistency, uniformity and co-ordination. The greater the formalisation, the less discretion could be given to the people employed in the organisation.

The degree of formalisation differs from one construction firm to another. Hillebrendt and Canon (1990 p 101); for instance pointed out that;

‘There is considerable diversity in the way in which decisions are taken. Some firms have a formalised system with, for example, subcommittees of the board, or committees set up by the board either to report to it or with delegated authority. Below main board level there may be similar formal structures. Other firms were proud that they did not set up committees but in these cases informal meetings were important as the means of hammering out a course of action. In all firms, a number of decisions are taken over the telephone especially where a speedy reaction to a problem is needed’.

A similar view was presented by Male and Stocks (1989) who said that a group develops its own unique culture and character as its becomes formalised and structured.

Faniran et al (1994), Pugh et al (1969) and (Sozen (1985) measured the formalisation of construction firms in terms of the extent to which rules, procedures,



instructions and communications are written down for the construction firms' various work tasks or assignments.

A similar method is employed in the present study. The respondents in the final postal questionnaire survey were asked the following question;

'Did your firm have written rules that the employees must obey in carrying out their day-to-day works when the refurbishment project was carried out?'

The responses are recorded on a five-point scale ranging from no written rules to extensive written rules. The result is shown in table 7.7. The higher the presence of the written rules, the higher the degree of formalisation of the construction firms.

Table 7.7 The formalisation of the construction firms

Degree of formalisation	Construction firms (N= 54) %
Lowly formalised (no/few written rules)	31.4
Moderately formalised (neutral)	24.1
Highly formalised (many/extensive written rules)	44.4

Table 7.7 reveals that the degree of formalisation of the construction firms is fairly evenly distributed, with bias slightly towards highly formalised. The highly formalised construction firms (with many written rules/extensive written rules) constitute the largest group, close to half of the total.

The Spearman's correlation technique used in this study found that the complexity and formalisation of the construction firms was significantly correlated (correlation coefficient of 0.36 at 0.01 significant level). This is similar to Sozen's (1985) finding.

The result that shows bias towards highly formalised construction firms was expected. In order to obtain complex and uncertain refurbishment projects, the present study

deliberately targeted medium to very large construction firms. The review of literature reveals that the more complex the construction firms, the higher the degree of formalisation (Sozen, 1985; Mintzberg, 1979). The high proportion of complex construction firms that participated in the final postal questionnaire survey resulted in a higher number of highly formalised construction firms.

Koontz et al (1972) maintained that large (complex) firms spend more investment on planning, have more detailed planning, longer time horizons and more expensive procedures than the small ones. In large firms, there are greater internal inflexibilities such as human psychology, policies and procedures and capital investment which may inhibit changes in big firms.

Koontz et al's (1972) observations imply that the inflexibilities of the construction firms would create situations in which an individual project may fail to get a flexible organisation structure or the organic approach that it needs. The extent to which the integrative mechanisms used in the planning and control process of refurbishment projects between construction firms of varying degree of formalisation was examined.

The Spearman's correlation technique was used to establish the association between the formalisation of the organisation structure of the construction firms and the integrative mechanisms used in the planning and control process of refurbishment projects. The results are shown in tables 7.8 and 7.9.

**Table 7.8** The correlations between the formalisation of the organisation structure of the construction firms and the involvement of the key participants in decision-making

Key participants	Pre-bid	Pre-construction	During construction
Estimator	-.12	.08	.21
Planning specialist	.31*	.26	.18
Contract management	.15	.01	.10
Site management	.18	.12	.05
Subcontractors	.24	.18	.06

\* at 0.05 significant level \*\* at 0.01 significant level

**Table 7.9** The correlations between the formalisation of the construction firms and the co-ordination devices

Co-ordination devices	Formalisation
Regular scheduled meeting	.27
Special meeting	.37**
Direct formal contact	.04
Direct informal contact	.38**
Construction firms' planning and control procedures	.36*
Communication skills and knowledge	.18
Project management computer software	.33*

\* 0.05 significant level \*\* 0.01 significant level

Close examination of table 7.8 reveals that the coefficients are not significantly different from the coefficients in table 7.3. Also, the coefficients in table 7.9 are similar to the coefficients in table 7.4. This is hardly surprising. Since the complexity of the construction firms is significantly associated with formalisation, what applies to complexity, also applies to formalisation. The author considers that in order to avoid repetition, it is unnecessary to explain the result, except for one interesting finding, i.e. the significant correlation between the formalisation of the construction firms and direct informal contact.

It has been argued that refurbishment projects require more flexibility in the organisation structure. The formalisation of the construction firms tends to cause inflexibility, which creates communication barriers between the key participants. To reduce these barriers, the key participants involved in complex refurbishment projects tend to circumvent the formalised procedures by placing more emphasis on direct informal contact, especially when speedy decisions are needed.

Walker (1989), for instance, maintained that when an organisation is inappropriately designed, it can still perform adequately, as people have the ability to construct informal organisation structures that circumvent the formal organisation structure often to the benefit of performance. However, a strong informal organisation structure can work against organisation co-ordination and control. The ideal is when the organisation is sufficiently well designed that it does not generate an informal organisation structure.

This result illustrates the 'conflict' between the needs of the construction firms and the needs of refurbishment projects. The more complex the construction firm, the greater the need for formalisation, to ensure that productivity and efficiency within the construction firm could be closely monitored. Refurbishment projects, on the other hand, require informal culture, which creates a greater tendency for the key participants involved in planning and control to obtain information informally.

#### 7.4 The centralisation of the construction firms

Galbraith's (1977) view was that there was a tendency for decentralisation in an organisation when faced with greater uncertainty. As the level of task uncertainty facing the firm increases, so pressure is put upon the hierarchical system for managing exceptions, during the task execution. This he categorised as information overload, to which the appropriate response is the establishment of additional, but increasing costly mechanisms which free upper levels of management from excessive involvement in detailed operational decision-making. This means that the point of decisions is kept at the level in the organisation at which the relevant information and

expertise exists. Child (1984) argued that more frequent and more complex decisions require decentralised decision-making.

Pugh et al (1969), Sozen (1985) and Faniran et al (1994) measured the degree of centralisation of construction firms by listing 19 decision areas in their questionnaire surveys. The respondents were then asked to indicate at what level of the firm's management hierarchy (low, middle or high) could executive action be authorised for the decisions. The low level covered the site personnel from ordinary worker to site manager. The middle level covered the employees at the headquarters including the managers while the high level covered the General Managers and the Board of Directors. Decisions taken by the low level scored 1; those by middle level scored 2 and by high level scored 3. The higher a firm's summed score, the higher the degree of centralisation of the construction firms.

The method used by Pugh et al (1969), Sozen (1985) and Faniran et al (1994) was criticised by Lansley (1994) as 'confusing, and taking too many factors'. Probably, the ambiguity of Pugh et al's (1969) method of measuring the degree of centralisation contributed Sozen's (1985) failure to find evidence to support his proposition that the larger the construction firm, the lower the level of centralisation of the organisation structure.

The author considers that the definition of middle level, which covers 'employees at the headquarters including the managers', is too wide and ambiguous. Employees at the head quarters include accounting clerks to contract directors. Besides many decision areas listed in Pugh et al's (1969) method, were considered by the author to overlap, for instance; 'the labour force requirements on site' and 'the appointment to direct workers on site'.

The method of measuring the degree of centralisation of organisation structure used by Pugh et al (1969) and Sozen (1985) was modified in the present study. The total of 19 decision areas in the Sozen's measure was reduced to 8, as shown in appendix L. The decision areas are to cover decisions that are related to the planning

and control process. For the measurement of the levels of management, the definitions used by Egbu (1994) were used instead. They are as follow:-

- a) Junior managers: includes the site personnel.
- b) Middle managers: includes the managers whose positions are between site manager and general managers.
- c) Senior managers: includes general manager and the board of directors.

From the returned final postal questionnaire, the construction firms were then classified as having low, moderate or high degree of centralisation, based on the points scored. Construction firms that scored less than 10 points were classified as lowly centralised, 10-15 points as moderately centralised and more than 15 points as highly centralised. The result is shown in table 7.10.

Table 7.10 The degree centralisation of construction firms

Degree of centralisation	Construction firm (N=54) %
Lowly centralised	3.7
Moderately centralised	74.1
Highly centralised	22.2

Table 7.10 reveals that almost three quarters of the construction firms are classified under moderately centralised. This is expected, as decisions on planning and control construction projects are mostly related to the operational rather than the strategic, which normally executed by middle managers. The bias is towards highly centralised. An explanation to the bias towards high centralisation is provided by Egbu (1994) who found a high involvement of senior managers in the decision-making process in refurbishment projects.

In his outline of the social technology framework, Clark (1989) anticipates the movement from a decentralised system, with a technostucture having low discretion and power and site management having high discretion and power, to a centralised system, where the discretion of the technostucture tends to be high and that of the site management tends to be low. At the same time, there would be a change in the way in which co-ordination within groups took place. The more powerful layer in the organisation (managers higher in the hierarchy) operating with continual mutual adjustment and feedback, and the less powerful (managers lower in the hierarchy) with more pre-planning.

Hillebrandt and Canon (1990), on the other hand, maintained that there is no confirmation of this change of centralisation in the organisation structure of construction firms.

The contradictory observations made by Clark (1989) and Hillebrandt and Canon (1990) prompted the author to make a closer examination of the types of decisions made by each level of management in the present study. Table 7.11 shows the management level whose approval must be obtained on eight decision areas.

**Table 7.11 The levels of management in which decisions are made in construction firms**

Decision areas	The percentage of refurbishment projects in which decisions are made by (N=54) %		
	Junior Manager	Middle Manager	Senior Manager
Number of technical personnel on site	2	29	69
Number of foreman/ supervisors on site	0	34	66
Negotiation with client and/or client's representative on site	4	47	49
Appointment of subcontractors on site	2	53	46
Choices of construction methods for the project	4	76	20
Selection of plant and equipment for the project	8	63	10
Labour force requirements on site	32	62	6

Table 7.11 reveals that in three out of eight decision areas, the mode is by senior managers. For the other five decision areas, the mode is by middle management. Only the decisions on the selection of plant and labour force requirement on site show a higher number of decisions being made by junior managers than by senior managers. The results indicate that the locus of decision-making in the construction firms is biased towards senior managers, which reflects the high degree of centralisation in the majority of construction firms.

Table 7.11, however, demonstrates that the degree of centralisation depends on the types of decisions. Operational decisions such as the choice of construction methods and selection of plant are mostly made by the middle managers. Negotiation with the client, which arguably involves largely strategic decisions, is mostly conducted by senior managers. It appears that the decisions on employment of labour personnel depends on level of the personnel in the hierarchy. The higher the position of the



personnel to be employed, the more likely it is that the decision about their employment is made by a senior manager. Thus, the decisions on the number of technical personnel and supervisors are mostly made by senior managers. Whereas the decisions on labour force requirements on site are mostly made by middle managers.

The results reveal the difficulty of measuring the degree of centralisation of construction firms and the danger of generalisation. The results are influenced by the types of decisions included in the measurements. Since there are numerous combinations of decision areas that could be included in the measurement it would, therefore, be difficult to achieve consistent results. This could also explain the contradictory observations made by Clark (1989) and Hillebrandt and Canon (1990), and the failure of Sozen (1985) to find evidence to support his proposition that the centralisation of organisation structure depends on the size of the construction firm. Admittedly, this difficulty, to some extent, also hinders this study to present any conclusive findings relating to the centralisation of the construction firms. It is suggested that a more consistent method of measuring the degree of centralisation of construction firms needs to be developed.

Similar to Sozen's (1985) finding, there is no correlation between the degree of centralisation and the complexity of the construction firms. The immediate implication of this result is that the delegation of authority does not depend on the complexity of the construction firm. Most probably, the degree of centralisation of construction firms depends on other factors such as the managerial style or the culture of the construction firms.

There are possible explanations for the lack of evidence to suggest that the construction firms with a higher degree of complexity tend to be more decentralised. Koontz (1972) cited various reasons that limit decentralisation. Some of the factors cited by Koontz (1972) were the loss of control, co-ordination, inadequate planning and control systems, limited availability of qualified managers involved and considerable expense for training managers.

Furthermore, the complexity and uncertainty of refurbishment projects involve higher risk and therefore need greater control and co-ordination. Decentralisation of authority would be easier in situations when activities could be routinised, as, for example in the manufacturing industry. This opportunity is more limited in construction firms that carry non-standardised construction projects.

The Spearman correlation technique was applied to find the correlations between the construction firm variables. The results are shown in table 7.12 and 7.13.

Table 7.12 The correlations between the centralisation of construction firms and the involvement of the key participants in decision-making

Key participants	Pre-bid	Pre-construction	During construction
Estimator	-.05	-.16	.03
Planning specialist	.05	-.19	.04
Contract management	.27	.12	.02
Site management	-.07	.08	.04
Subcontractors	.06	.15	-.11

\* at 0.05 significant level    \*\* at 0.01 significant level

Table 7.13 The correlations between the centralisation of construction firms and the co-ordination devices

Co-ordination devices	Centralisation
Regular scheduled meeting	-.12
Special meeting	.15
Direct formal contact	-.13
Direct informal contact	-.19
Construction firms' planning and control procedures	-.02
Communication skills and knowledge	.14
	.11

\* 0.05 significant level    \*\* 0.01 significant level

Table 7.12 and 7.13 reveal that no significant correlations between the centralisation of the construction firms and the integrative mechanisms used in planning and control process of refurbishment projects. It could be argued the established procedures and the complexity and uncertainty faced by the refurbishment projects organisation dilute the influence of the authority to decide on the extent of the integrative mechanisms employed in the planning and control process of refurbishment projects. The complexity and formalisation of the construction firms play more significant role in determining the extent to which the integrative mechanisms are used in the planning and control process.

#### 7.5 The associations between the organisation structure and the planning performance

Faniran et al (1994), Tucker (1986) and Kabaskal et al (1989) suggested that the organisation structure that firms have influences the effectiveness of construction planning efforts.

Walker (1989) maintained that there are many factors other than organisation structure that have a significant bearing upon the performance of an organisation. However, organisation structure is particularly important aspect as, if properly designed, it allows the other aspects to function properly.

Galbraith (1977) maintained that various strategies could be employed by organisations. For instance, an organisation may use greater integrative mechanisms to increase the level of performance. Or an organisation, due to limited information processing capability or resources, may opt for a reduction in the use of integrative mechanisms and only aim for lower level of performance. Which strategy is chosen depends on the type of uncertainty and the ability of the organisation to increase its capacity for processing information.

This study hypothesised that the organisation structure of the construction firms affects planning performance.

The results from the Spearman correlation technique are shown in table 7.14.

Table 7.14 Correlation between organisation structure and planning performance

Planning performance	Complexity	Formalisation	Centralisation
Cost variance	.14	.09	.05
Time variance	.20	.14	.09
Quality of workmanship	.25	.02	.21
The extent to which the planning techniques are used for monitoring	-.29*	.23	.11

Table 7.14 reveals that there is only one significant correlation, i.e. increased complexity of construction firm is associated with a greater extent to which the planning techniques are used for monitoring during-construction.

This result is anticipated. The more complex the construction firms, the greater the tendency for the construction firms to employ planning specialists and to use computer software in the planning and control process. It has been established that the greater the involvement of planning specialist in the preparation of planning techniques and the use of computer software, the greater the detail of planning techniques. The greater the detail of the planning techniques, the more likely they are used for monitoring, as any deviations in the plans could be detected more easily. This is reflected in the fact that the complex construction firms tend to place more emphasis on the ability to gather more information early to reduce uncertainty and to preplan.

Neale and Neale (1989) and Harrison (1991), however, argued that the employment of complex numbers of planners cannot in itself ensure against project overrun and overspend. It is important to ensure that other key participants are also involved in the preparation of plans. In terms of cost variance, the result appears to support Neale and Neale's (1989) argument. In fact it shows that there is zero correlation between firm size and cost variance.

As a matter of interest, a result from Faniran et al's (1994) study is presented here. Faniran et al (1994) discovered that increased centralisation was associated with increased cost variance. Faniran et al (1994) attributed this to the competing interests of managerial activities at higher levels of authority, leaving less time available for construction planning activities, thereby resulting in less efficient projects. This is an interesting view, but rather far-fetched. If Faniran et al's (1994) result is correct, then the possible explanation is that increased centralisation lengthens the time of communication from the decision-makers (those higher in the hierarchy, located at the head office) to the implementers (those in the lower hierarchy, located on site). The uncertainty of construction projects requires speedy feedback. Delays in decision-making invariably affect the effectiveness of cost-controlling. However, neither of this explanation could be applied to this study.

It is interesting to note that even though the complex construction firms tend to use more resources in the planning and control process, their planning performance is not found to be significantly better than the simple construction firms. This reinforces the argument that the more complex construction firms should create an autonomous refurbishment department or a subsidiary firm in order to be more efficient and possibly, more effective.

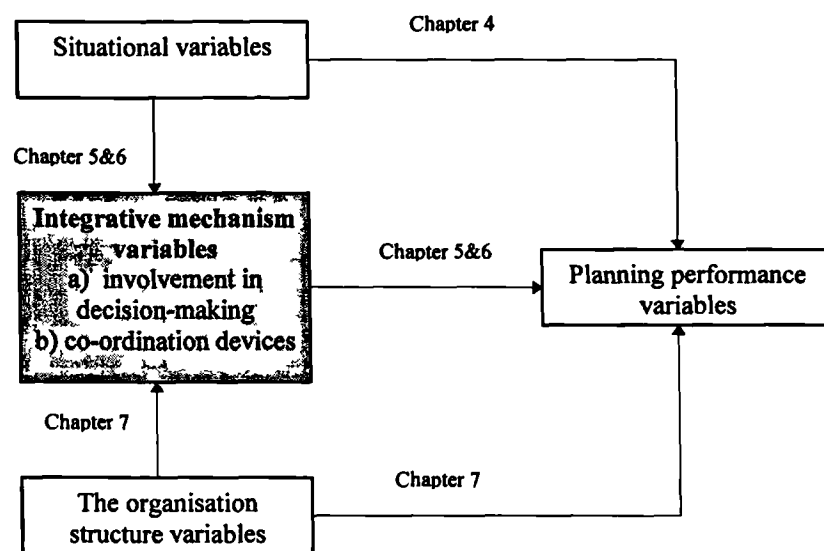
## 7.6 The description of the theoretical framework

This study has described in detail the methods of achieving integration in the planning and control process of refurbishment projects. The main hypotheses, listed in chapter 1 have been tested. The main hypotheses were formulated from the theoretical framework shown on page 93. A simplified version of the theoretical framework is shown in figure 7.3.

The theoretical framework has four components or sets of variables, i.e. the situational, organisation structure, integrative mechanisms and planning performance variables. The integrative mechanisms' variables are sub-divided into two a) the involvement of the key participants in decision-making and b) the co-ordination

devices. The information processing capacity of refurbishment project organisations depends on the extent to which the integrative mechanisms are used in the planning and control process. The central tenet of the theoretical framework is that the extent to which the integrative mechanisms are used in the planning and control process depends on the degree of complexity of the situational and organisation structure variables and the level of planning performance required.

Figure 7.3 The theoretical framework



The associations among the four components of the theoretical framework have been described in detail in the chapters indicated in figure 7.3. The Spearman's and Kendal's-tau-b correlation techniques were used to establish the associations between each set of variables. The models shown in figures 7.4 to 7.7 are constructed based on the correlational studies. In the models, each box represents a variable. Two significantly correlated variables are linked by a line. The integrative mechanisms' variables that are significantly correlated with the planning performance variables are represented by shaded boxes.

Initially, only the associations between the situational variables and the planning performance variables were included in the models. These associations had been examined and discussed in chapter 4. As the thesis progressed, more and more details were added to the models.

The associations between the involvement of the key participants in decision-making and the situational variables shown in figures 7.4, 7.5 and 7.6 were established in chapter 5. Also established in this chapter are the associations between the involvement of the key participants in decision-making and planning performance variables. The semi-completed models are shown in figures 5.6, 5.7 and 5.8 in chapter 5.

The associations between the co-ordination devices and the planning performance variables shown in figure 7.7 were established in chapter 6. Chapter 6 also establishes the associations between the co-ordination devices and the situational variables. The semi-completed model is shown in figure 6.5.

The associations between the organisation structure variables and integrative mechanisms' variables were established in section 7.2 to 7.4. There are three variables of organisation structure, i.e., complexity, formalisation and centralisation. To complete all the four models, the associations between the complexity of organisation structure and the integrative mechanisms are added to all the four models.

The formalisation variable is excluded from the models to avoid repetitions. It was found in section 7.3 that the formalisation of the organisation structure is strongly correlated with the complexity of the organisation structure. The integrative mechanism variables that are significantly correlated with the complexity of organisation structure have also been found to be significantly correlated with the formalisation of organisation structure.

The centralisation variable is excluded from the model because not a single integrative mechanism variable was to be found significantly correlated to it. This thesis has suggested that the measurement for centralisation needs to be improved to ensure its validity.

The main objective here is to provide a holistic view of the theoretical framework. Special emphasis is placed on the links between the integrative mechanisms and the other three components of the theoretical framework, i.e., the situational variables, the complexity of the construction firms and the planning performance variables. By looking at the models holistically, refurbishment project organisations will be able to prioritise the integrative mechanisms to be used in the planning and control process.

Close examination of the four models reveals that all the planning performance variables are significantly associated with at least one integrative mechanism. For examples:

- The cost variance is significantly associated with the involvement of the estimator in decision-making during construction stage (figure 7.6).
- The time variance is associated with planning and control procedures (figure 7.7).
- The quality of workmanship is associated with scheduled meetings (figure 7.7).
- The extent to which the planning techniques are used for monitoring is associated with the involvement of planning specialist in decision-making (figures 7.4 and 7.6).

Nevertheless, not one of the integrative mechanisms could significantly improve all the planning performance variables simultaneously. Thus, to improve all the planning performance areas, refurbishment project organisations need to increase the use of all integrative mechanisms simultaneously. This requires the refurbishment project organisations to increase the use of resources substantially. If this is not possible, then the refurbishment project organisations need to aim for lower planning performance. Alternatively, the refurbishment project organisations need to prioritise the planning performance criteria.



Figure 7.6 for instance shows that if cost variance is the highest priority, then the refurbishment project organisations should strive for increased involvement of estimator in decision-making during construction stage. If time variance is the highest priority, then the refurbishment project organisations should increase the use of planning and control procedures (see figure 7.7).

However, the planning performance variables should not be the only the criteria in determining the extent to which the integrative mechanisms are used in the planning and control process. The nature of the complexity of the refurbishment projects should also be considered. The models presented here indicate the situations in which the estimator and other key participants need to be highly involved in decision-making. Figure 7.4 for instance, shows that the degree of involvement of the estimator in decision-making during construction stage is not only significantly correlated with the cost variance, but also with the percentage of provisional sum to project contract value. To reduce cost variance, the involvement of the estimator in decision-making during construction stage needs to be increased. When the percentage of the provisional sum to project contract value increased, the involvement of the estimator needs to increased further.

An additional difficulty faced by refurbishment project organisations is that the situational variables affect the involvement of the key participants in decision-making differently. Figure 7.4 for instance shows that increased services work requires increased involvement of subcontractors during pre-bid stage. Increased provisional sum to project contract value however requires increased involvement of the estimator during pre-construction stage (see figure 7.5). The nature of complexity of refurbishment projects requires that the involvement of the key participants be adjusted at the three refurbishment project stages. This shows that the organisation of refurbishment projects needs to be flexible in order to cope with the complexity of the situational variables. The key participants may be required to be highly involved in decision-making outside their domain.

The involvement of the planning specialist in decision-making is significantly influenced by more situational variables compared to the other five key participants (see figure 7.4 to 7.6). In addition, the involvement of the planning specialist is also significantly influenced by the complexity of the construction firms. It appears that the planning specialist functions as 'uncertainty absorber'. The planning specialist appears to gain more power with increased complexity and uncertainty of refurbishment projects compared to other key participants.

Thus the planning specialist, should be trained to cope with uncertainty. In uncertain projects, interrelated decisions made by the key participants need to be co-ordinated. This requires the planning specialist to be in constant contact with other key participants. The planning specialist must be at the centre of information. Changes in design during construction for instance, require the planning specialist to revise the planning techniques. The revised planning techniques need to be distributed efficiently to other key participants. Thus the planning specialist must have high skills in communication and information technology to ensure that the information flow efficiently in the refurbishment project organisation.

The nature of complexity of refurbishment projects also appears to significantly influence the extent to which the different co-ordination devices are used in the planning and control process. Figure 7.7 shows that increased difficulty of access requires increased scheduled meetings. Increased project size requires increased use of planning and control procedures. If the time variance is the main priority, then the use of the procedures needs to be increased further. Therefore, adjustments to the co-ordination devices also need to be made, depending on the nature of the complexity of refurbishment projects and also the planning performance required.

To compound the problem, the degree of complexity of the construction firms also influences the extent to which the integrative mechanisms are used in the planning and control process. For instance, the more complex the construction firm, the greater the involvement of the planning specialist in decision-making. Also, the more complex the construction firms, the greater the extent to which the planning and control procedures are used in the planning and control process.

In summary, the extent to which the integrative mechanisms used in the planning and control process depends on the nature of the complexity of situational variables and construction firms and planning performance required. Since each refurbishment project is unique, refurbishment project organisations must apply contingency approach in deciding the level of integrative mechanisms employed in the planning and control process. The three sets of variables that influenced the integrative mechanisms used in refurbishment projects need to be considered holistically. The models presented here could help refurbishment project organisations to prioritise the integrative mechanisms to be used in the planning and control process.

Figure 7.4 A model of the involvement of the key participants in decision-making during pre-bid.

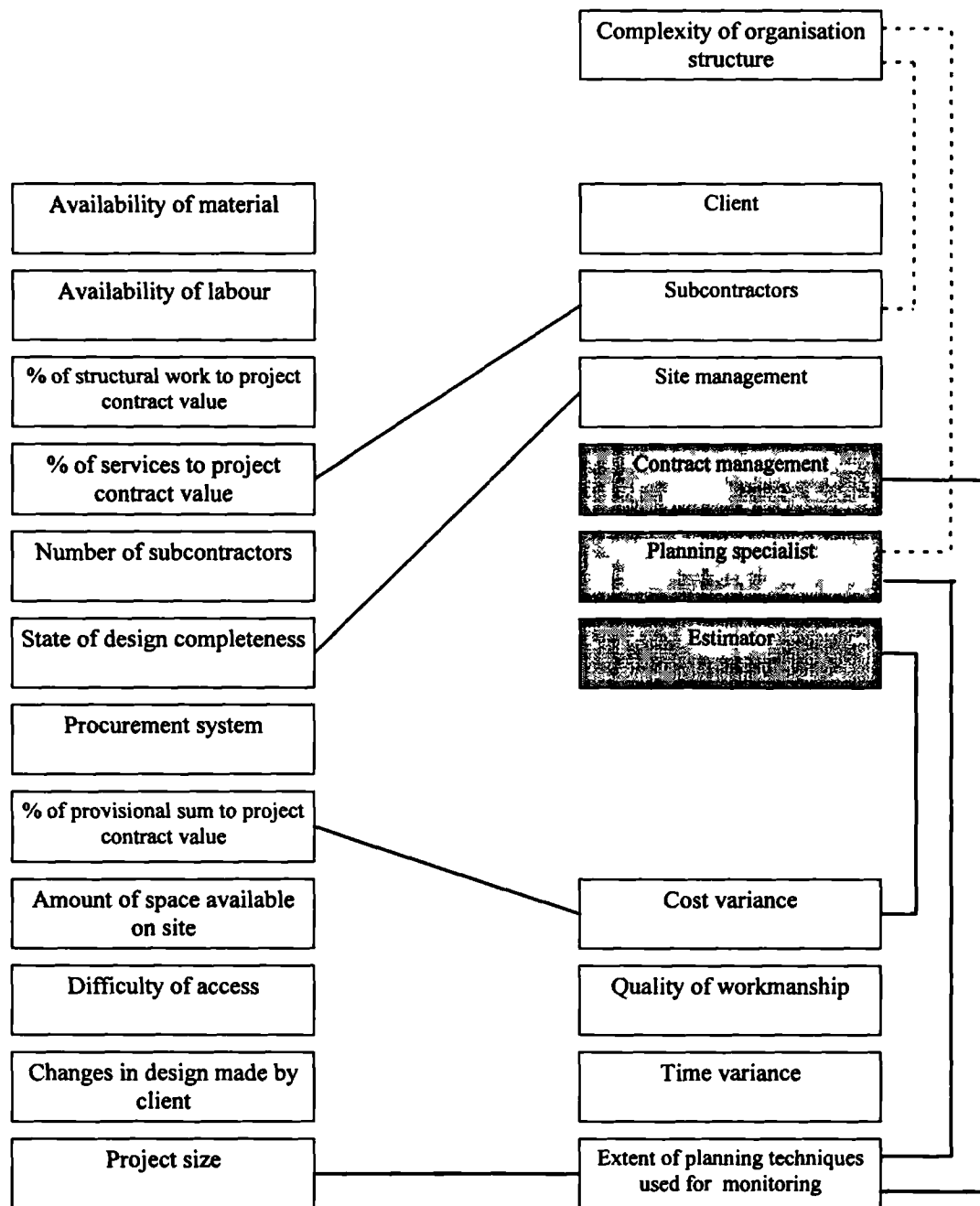


Figure 7.5 A model of the involvement of the key participants in decision-making during pre-construction

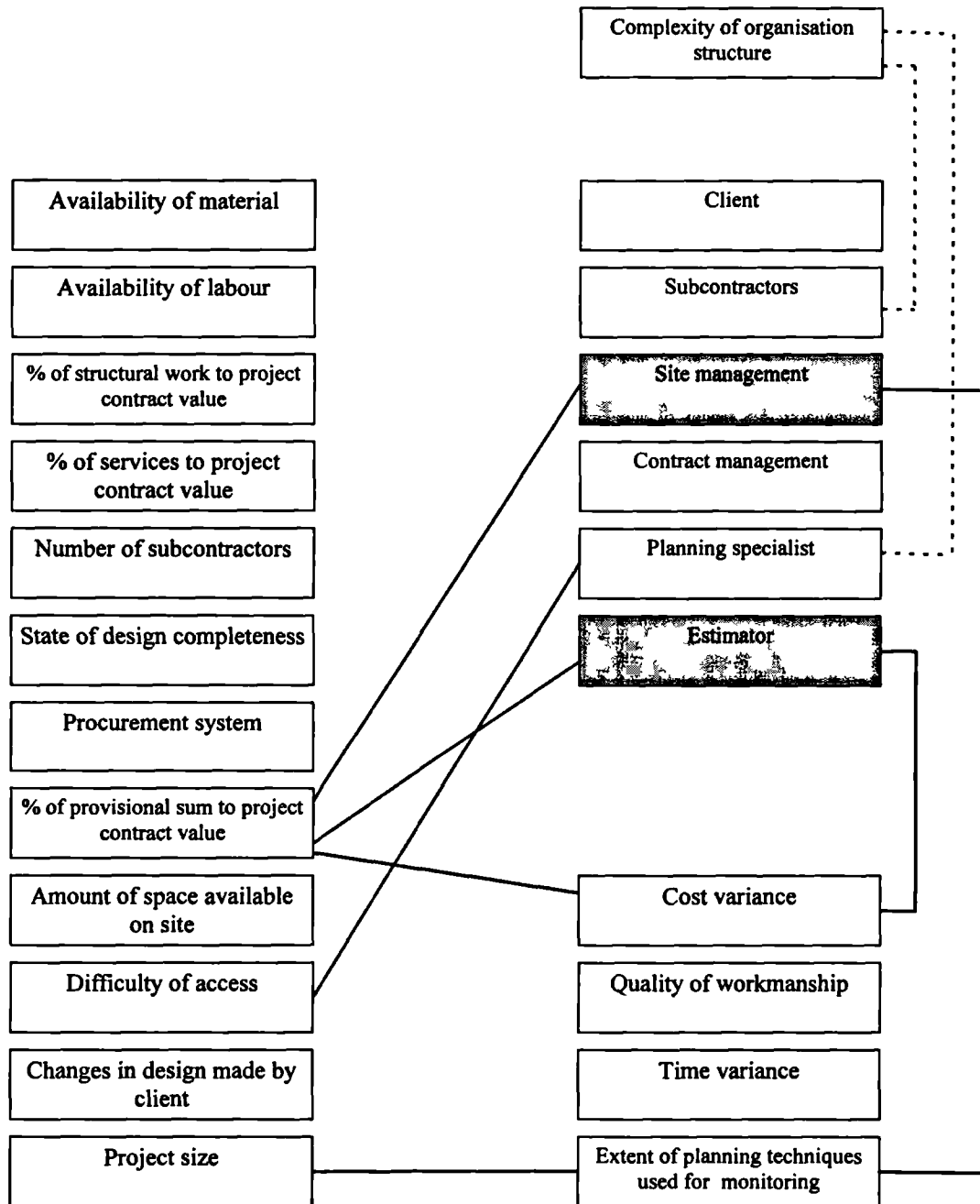
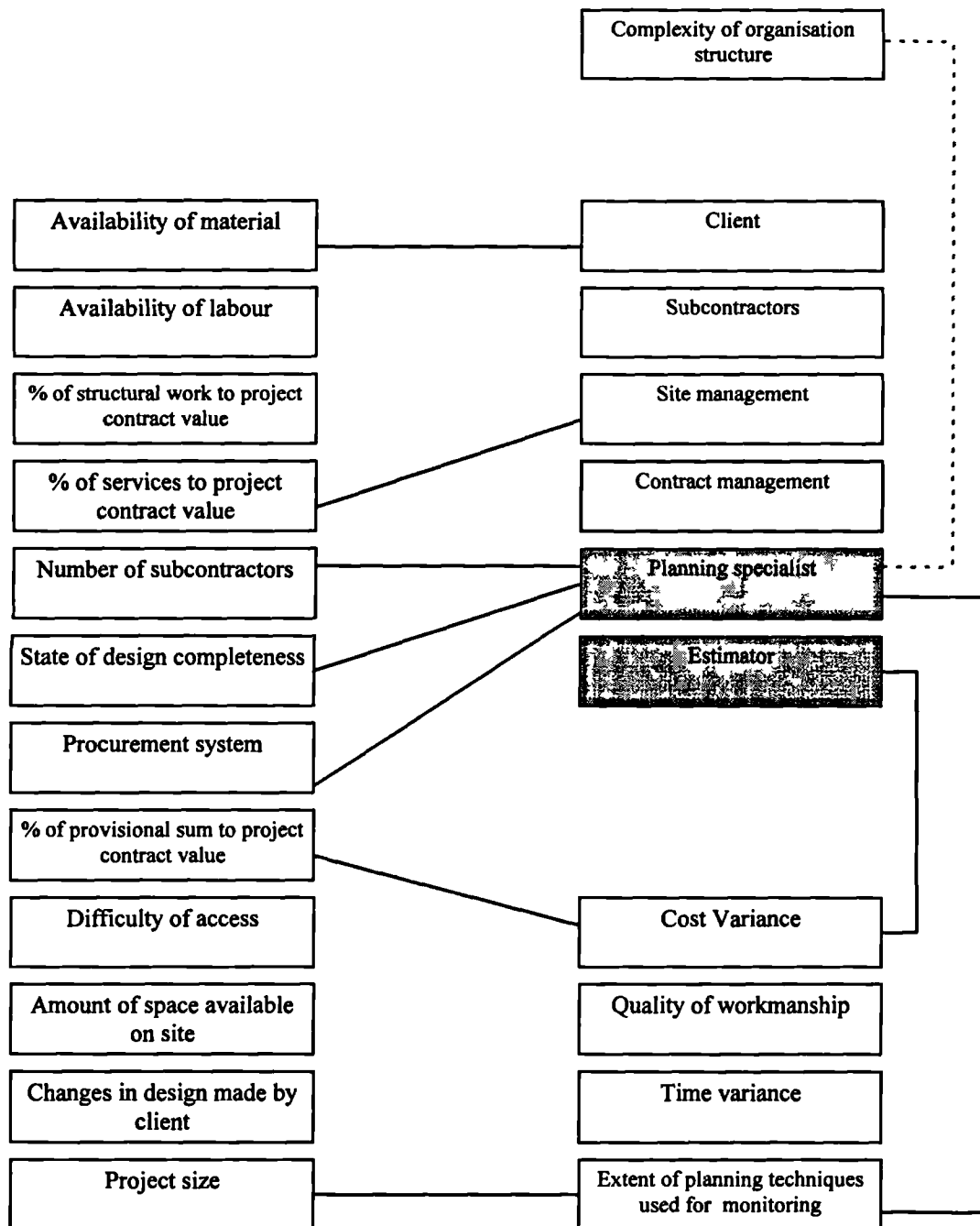
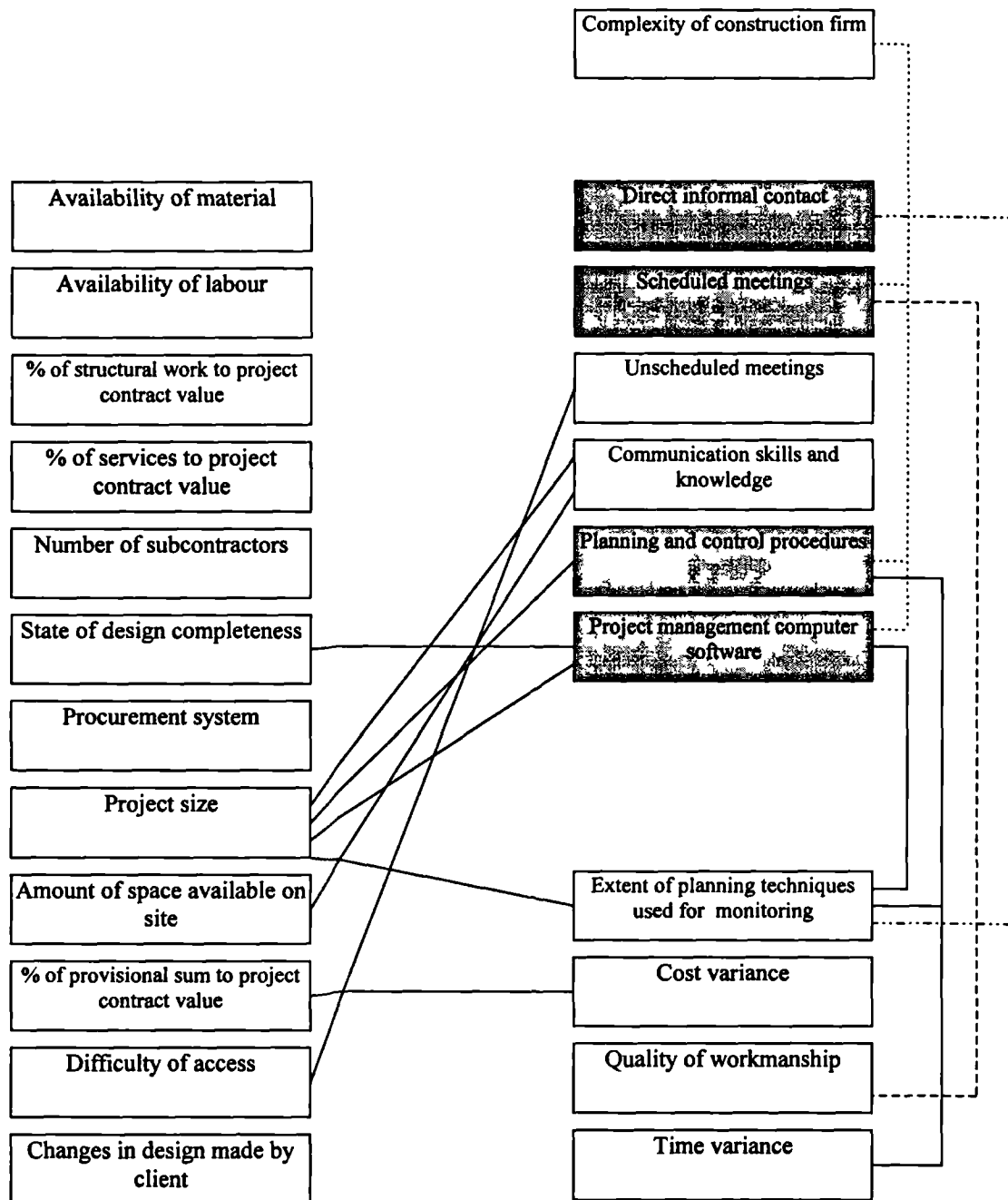


Figure 7.6 A model of the involvement of the key participants in decision-making during construction stage.



**Figure 7.7 The co-ordination devices model**



## 7.7 Summary and recommendations

The review of literature reveals that the management approach of construction firms tends to differ. The difference is mainly due to differences in their capacity to process information.

The literature review also reveals that the construction firms face the dilemma of satisfying the needs of the firm and the needs of the projects. The needs of the construction firms are reflected in the firms' organisational characteristics and that the needs of the refurbishment projects are reflected in the use of integrative mechanisms in the planning and control process. The construction firms have to satisfy these needs with the limited resources available to them. In order to satisfy these needs, the construction firms have to produce a coherent strategy.

The present study analyses the organisation structure of the construction firms undertaking the refurbishment projects. The methods and limitations of measuring the organisation structure are explained in detail.

It was found that a high proportion of the construction firms had more than 10 departments. Close to half of them were found to be highly formalised. There was a significant correlation between the complexity and formalisation of the construction firms. This study exposed difficulties in measuring the degree of centralisation of the organisation structure and recommends that a more consistent method of measuring it needs to be developed.

The results of the present study also show that the more complex the construction firms, the greater integrative mechanisms being used in the planning and control process.

The more complex the construction firms, for example: -

- The higher the involvement of planning specialists and subcontractors in decision-making.



- The higher the extent to which the planning and control procedures are used.
- The higher the degree of communication skills and knowledge of the key participants.
- The greater the emphasis placed upon lateral relations.
- The more likely they are to use project management computer software in planning and control process.

There is little evidence to show complex construction firms are associated with higher planning performance. It is concluded that the benefits of increased use of integrative mechanisms in the complex construction firms are hampered by them having to cope with increased complexity of their organisation structure.

The complexity of the construction firms appears to reduce the efficiency in the use of resources. It is suggested that complex construction firms should create an autonomous refurbishment department or refurbishment subsidiary in order to compete with less complex construction firms.

## **Chapter 8**

### **Summary, conclusions and recommendations**

#### **8.0 Introduction**

This study is about the planning and control process of refurbishment projects. It focuses on the issues of managing the complexity and uncertainty and the planning performance of refurbishment projects.

This chapter summarises the main conclusions and re-states the main objectives of this study. In addition, recommendations are made to direct research efforts into other potential areas of refurbishment management requiring examination.

#### **8.1 Summary of conclusions**

The study commenced with a literature review, which suggested that knowledge was sparse in the management of refurbishment. Evidence has shown that the studies on project management that do exist on construction are directed towards new build with little emphasis being placed upon the area of refurbishment project management.

Within the domain of refurbishment management, planning and control were discovered to be the two most difficult tasks facing refurbishment managers. There is no widely understood and accepted framework to provide guidance for refurbishment managers in the planning and control process of refurbishment projects.

The review of literature suggested that research should commence with a systematic study of the methods of providing integration in the planning and control process, thus encompassing the sphere of decision-making and co-ordination devices.

The planning and control process of refurbishment projects was chosen by the author as the theme of this study. The author adopted a systematic approach by extensively studying the literature in the domains of construction management, project organisation, refurbishment projects and the planning and control process. Within this framework a preliminary postal questionnaire survey was conducted. One hundred and three (103) construction firms responded positively to the questionnaires. From these construction firms, fifteen (15) planning and control managers from fifteen (15) different construction firms were interviewed. In addition, a second postal questionnaire was distributed to refurbishment managers employed in the same construction firms who responded to the preliminary postal questionnaire survey. In all, sixty-seven (67) managers responded positively to the final postal questionnaire survey.

Analysing the literature, discussion with the planning and control managers in the field of refurbishment management, together with archive documents collected at the interviews and the data from the preliminary and final postal questionnaires enabled the following conclusions to be drawn.

Commencing with the importance and growth of the refurbishment sector, the main conclusions are: -

- a) The refurbishment sector will keep contributing significantly to the overall UK construction output for the foreseeable future. The large stock of redundant and ageing buildings, modernisation, social, economic, political and changes in technology are the major factors that will ensure the continuing importance of the refurbishment sector in the construction industry.

The study proceeded by analysing the planning performance of refurbishment projects and comparing the results with previous studies. The main conclusion is that;

- b) Based on four planning performance criteria, the planning performance of refurbishment projects is mixed. More than half of refurbishment projects exceed

the target construction cost and target construction time. In the vast majority of refurbishment projects, the planning techniques are extensively used for monitoring during construction. The extent to which the planning techniques are used for monitoring during construction is influenced by the degree of detail of the planning techniques.

The complexity and uncertainty of refurbishment projects were the focus of the following chapter. The main conclusions are as follows: -

- c) In general, the majority of refurbishment projects suffer from task complexity and uncertainty. Less than a fifth of refurbishment projects started work with more than 80% of design being complete. The vast majority of refurbishment projects is subjected to extensive changes in design during construction. The planning techniques prepared and used in refurbishment projects are frequently revised.
- d) Highly specialised skills and knowledge are required in refurbishment projects. This is reflected in the large number of subcontractors employed and a high content of services work in the majority of refurbishment projects. The percentage of services work relative to contract value and the provisional sum are significantly correlated. The provisional sum is the major influence for refurbishment projects to exceed target cost. The high content of services work requires refurbishment project organisations to employ site management with services expertise.
- e) The majority of refurbishment projects have limited space for storage of materials on site. Difficult access is also a common feature in many refurbishment projects. These problems are exacerbated in refurbishment projects with a large amount of structural work. These interferences, often require materials for refurbishment projects to be delivered outside normal working hours.

Evidence suggests that refurbishment projects using the design and build procurement system perform better than do those using the traditional procurement system. Refurbishment projects using design and build are less likely to exceed target construction cost and target construction time.

The integrative mechanisms employed in the planning and control process of refurbishment projects were the central theme of the next two chapters. The main conclusions are as follows: -

- f) There is differentiation of tasks in decision-making in the planning and control process of refurbishment projects. The key participants involved in the planning and control process are grouped into three, based on their 'domain'. The first group is the long-term planners (estimator and planning specialist) who are dominant at the pre-bid stage. The second group is the short-term planners (contract management and site management and subcontractors) who are dominant during the construction stage. The client is unique, with no domain. The differentiation produced decision-making gaps.

The planning and control process of refurbishment projects requires both differentiation and integration of tasks. Differentiation is important to ensure efficient use of resources and to minimise conflicts. Integration is important to ensure the activities of the key participants are co-ordinated.

- g) There is no evidence to suggest that increased involvement of site management and subcontractors in decision-making outside their domain improves planning performance. Thus site management and subcontractors are expected in most circumstances to remain in their domain, i.e. during the construction stage. However, incomplete design information before refurbishment work commenced on site may necessitate higher involvement of the site management in decision-making during pre-bid stage.

- h) The planning specialist and contract management are expected to function as integrators in the planning and control process of refurbishment projects. They are strongly involved throughout the duration of refurbishment projects.
- i) Increased complexity and uncertainty of refurbishment projects frequently require multiphased integration in the refurbishment project organisations. This is provided by increased involvement of the key participants in decision-making outside their domain. Evidence suggests that increased involvement of estimator, planning specialist, and contract management outside their domain improves planning performance.

There is significant correlation between the involvement of estimator in decision-making during construction with cost variance.

There is also significant correlation between the extent to which the planning techniques are used for monitoring during construction with:

- The involvement of planning specialist in decision-making during construction stage.
- The involvement of the contract management in decision-making during pre-bid stage.

The above conclusions demonstrate the conflicting needs and the difficulty of managing refurbishment projects. The tasks of the key participants are differentiated but in certain situations need to be integrated. The key participants need to remain in their own domain to avoid conflicts, and yet frequently need to venture outside their domain to increase co-ordination. The key participants involved in refurbishment projects therefore, must be professional in their own domain but must be flexible and have a sound understanding of the nature of work of the key participants outside their domain.

The integrative mechanisms employed to increase the information processing capacity in refurbishment project organisations were further examined in the following chapter.

The conclusions are as follows: -

The refurbishment project organisations require both formal and informal interactions. The key participants are required to interact on a one to one basis and in-groups. All forms of interactions are important, and complement each other.

- g) Direct informal contact and the extent to which the planning techniques used during construction are correlated. Direct informal contact, brings flexibility in the planning and control process. It enables the key participants involved in the planning and control process to respond speedily to unexpected changes and to new and additional information, as it becomes available. It should therefore be encouraged. Whenever possible, the key participants should be co-located and/or directly linked by an efficient information system technique.
- h) The complexity and uncertainty of refurbishment projects however tend to create opportunistic behaviour and conflicts. Information obtained formally is useful to clarify contractual obligations, and as evidence, in case of litigation. Information exchanged between two different parties from different organisations, such as between client and contractor, is frequently by direct formal contact. The information needs to be systematically verified and documented.
- i) The need to co-ordinate the planning and control of information requires frequent scheduled meetings among the key participants. This to ensure that the information possessed by all key participants is up-to-date and consistent. The scheduled meetings should be used to achieve information parity among the key participants, and to ensure that they are not withholding information from one another. Scheduled meetings and the quality of workmanship are correlated.
- j) The tendency for unexpected changes to occur in refurbishment projects requires frequent unscheduled meetings to be arranged, to deal with problems faced by one

or more of the key participants involved. These require all key participants to be flexible and not burdened by personal interests or their company's bureaucracy.

The above conclusions demonstrate more conflicting needs in the planning and control process of refurbishment projects. It needs to be formal and yet informal at the same time. No single mode of interactions is dominant.

- k) To ensure deviations are detected early and speedily, systematic planning and control procedures need to be used and followed. The higher the extent to which the planning and control procedures were used in the refurbishment projects, the lower the time variance. The planning and control procedures should clearly define the roles of the key participants, indicate the planning techniques to be used by them. The complexity and uncertainty of refurbishment projects however, require the procedures to be flexible.

Further conflicting needs in the planning and control process of refurbishment projects are shown by the above conclusions. Procedures, by definition, should be rigid. Refurbishment projects however require 'flexible planning and control procedures'. The design of the planning and control procedures must take into consideration the views of all key participants involved.

- l) The key participants involved in the planning and control process of refurbishment projects are required to use both lowly and highly coded information. The key participants must have multifarious communication skills and knowledge, verbal and written and as well as being able to interpret drawings and interface with computers.
- m) The potential for information technology is not yet fully exploited in the planning and control process of refurbishment projects. At present, the use of information technology in the planning and control process is rather fragmented. However, the project management computer software, which is mainly used for scheduling, is already widely used. The use of project management computer software and the



extent to which the planning techniques are used for monitoring during construction are correlated.

- n) No single integrative mechanism appears to improve the planning performance of refurbishment projects simultaneously. Refurbishment project organisations require all the integrative mechanisms to achieve the desired planning performance in all areas. To achieve efficiency, refurbishment project organisations need to prioritise the project objectives.

The effects of the organisation structure of the construction firms on the extent to which the integrative mechanisms were used in the planning and control process was the central issue of the final chapter. The conclusions are summarised as follows: -

- o) The complexity of the construction firms undertaking refurbishment projects tends to compound the complexity and uncertainty of refurbishment projects. Evidence suggests that increased specialisation within construction firms reduces the efficiency in the planning and control process. Complex construction firms are more likely to employ higher levels of integrative mechanisms than simple construction firms. There is no evidence to suggest that complex construction firms perform better than simple construction firms. A complex construction firm may require to create an autonomous refurbishment department or a refurbishment subsidiary to increase efficiency in the planning and control process.

In summary, there is one distinctive feature in the planning and control process of refurbishment projects, i.e. conflicting demands. It requires differentiation and integration of tasks, formal and informal interactions, rigid and yet flexible procedures. The conflicting needs of refurbishment projects and the needs of the construction firms further compound this.

There is no simple, definitive answer to the planning and control process of refurbishment projects. The conflicting elements pose a difficult choice for the refurbishment projects organisation. In most instances, the appropriate choice is not

either/or but how to achieve both. Refurbishment project organisations must handle the problems of complexity and uncertainty of refurbishment projects holistically.

The conclusions in chapters 3 to 7 as well as the model presented in chapter 7 provide guidance to the refurbishment project organisations to find the appropriate balance between the complexity and uncertainty of refurbishment projects, the integrative mechanisms to be employed in the planning and control process and the level of planning performance required.

## 8.2 Recommendations for further research

1. An in-depth study of each situational variable that causes complexity and uncertainty of refurbishment projects. For example, research by case study could be conducted to provide 'how best' guidelines for refurbishment projects with inadequate design completed before refurbishment work on site commences. The types of refurbishment projects of significant interests are those with high services and structural content and projects that employed large number of subcontractors.
2. A study of the 'transaction cost' between the main contractor and the subcontractors or between the main contractors and the client. The main aim of this study would be to reduce the 'opportunistic behaviour' of the participants involved in complex and uncertain refurbishment projects. It would also help to improve inter-organisational integration and reduce inter-organisational conflicts.
3. A study of the application of information technology in planning and control of refurbishment projects. The main objective would be to establish the potential of information technology to help to increase integration in the planning and control process of refurbishment projects, with the view for more effectively integrating the key participants who are located on different sites, at different times and employed in different organisations.

4. A study of methods of improving delivery systems in refurbishment projects. The concept of 'Just in time' is of significant interest in view of the difficulty of access to refurbishment project sites and the limited space to store materials on site.
5. A study of refurbishment projects using other types of procurement system (such as construction management and project management).
6. Having considered the medium and large refurbishment firms in the present study, research is needed to establish integration mechanisms needed in smaller construction firms. This would allow a comparative analysis to be made across all sizes of refurbishment firms and refurbishment projects.

The Bartlett  
University College London  
22 Gordon Street  
London WC1H 0QB  
tel 071-380 7509  
fax 071-380 7517

## Appendix A

Victor Torrance CBE  
London Master Builders' Professor of Building

### TO WHOM IT MAY CONCERN

28 November 1994

### Research into Refurbishment Contract Management by Mr Ismail Rahmat

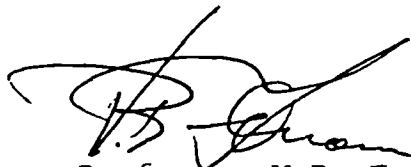
This is simply a brief introductory letter to inform you that Mr. Ismail Rahmat is conducting research into the Planning and Control Processes of Construction Refurbishment Contracts. He is working under the supervision of Professor Barbara Young and myself at the Bartlett School.

Mr. Rahmat is a staff member of the of Mara Institute of Technology in Malaysia, who is on secondment to UCL in order to carry out the research work leading to a PhD degree.

My colleagues and I are aware of the considerable pressure on your time, but we shall be most grateful if you will complete the questionnaire attached to Mr. Rahmat's letter enclosed and return it to him at your earliest convenient opportunity.

With much appreciation.

Yours faithfully,



Professor V.B. Torrance

enc.



The Bartlett School of Architecture Building  
Environmental Design and Planning  
Faculty of the Built Environment

The Bartlett  
University College London  
22 Gordon Street  
London WC1H 0QB  
tel 071-380 7509  
fax 071-380 7517

## Appendix B

Victor Torrance CBE  
London Master Builders' Professor of Building

Dear Sir/Madam,

### Survey of Planning and Control Processes of Refurbishment Projects

I am writing to ask if you would be kind enough to provide me with some information about your company and your general views on the planning control processes of refurbishment contracts.

I am a member of staff from the MARA Institute of Technology in Malaysia, working for the PhD degree, supervised by Professor Barbara Young and Professor Victor Torrance. My research started in February this year and is now entering the preliminary data collection stage. It is linked to the research in planning and control techniques across two industrial sectors (shipping and construction), being carried out by the Department of Construction Management, University College London.

I am sending this letter to you and to a cross-section of other construction companies operating in London and the South East. You will appreciate that I am anxious to get a reply from each person I write to in order to get as many points of view as possible, so I do hope that you will be willing to co-operate.

The questionnaire enclosed with this letter is designed to take only a few minutes to complete. Therefore, it would be very helpful if you were able to complete it yourself. If this is not possible, I would be obliged if you would ask a senior member of your company who participates actively in the planning and control of refurbishment projects to complete it instead.

.../...



The Bartlett School of Architecture, Building,  
Environmental Design and Planning  
Faculty of the Built Environment

I hope that your company will be able to benefit directly from this research, when fully completed, as the results obtained will be sent to you free of charge upon request. It is generally agreed that forecasting and planning are among the most difficult tasks facing managers in refurbishment contracts. I anticipate that the final results obtained will contribute to improving this situation.

Please be assured that both your identity, that of your company and information provided will remain strictly confidential. I would be very grateful if you could return the completed questionnaire to me as soon as possible.

I hope you will agree to assist us in our research.

Yours faithfully,

Ismail Rahmat

## SURVEY ON THE CONSTRUCTION PLANNING AND CONTROL OF REFURBISHMENT PROJECTS

Return Address Ismail Rahmat  
The Bartlett, Phillips House  
University College London  
Gower Street  
London WC1E 6BT

Reference:

Telephone: 071 387 7050 ext 5963

**Note about the questionnaire:**

Please answer every question. If you are unable to answer some of the questions because you consider them irrelevant or unclear, please put a question mark next to them. However, it is our hope that you will answer the remainder of the questionnaire.

Your identity and that of your firm will remain strictly confidential to us.

**Refurbishment** refers to all works carried out on existing building. This includes modernisation, conversion, renovation, rehabilitation, retrofit and repair. It excludes regular maintenance works such as painting, decoration and cleaning.

**1 YOUR PARTICULARS**

1.1 Job title \_\_\_\_\_

1.2 How long have you worked in the construction industry

- ☐ Less than a year      ☐ 1- 5 years  
☐ 6-10 years            ☐ 11-15 years  
☐ 16- 20 years           ☐ more than 20 years

1.3 How long have you been involved in planning and/or controlling refurbishment projects

- ☐ Less than a year      ☐ 1- 5 years  
☐ 6-10 years            ☐ 11-15 years  
☐ 16- 20 years           ☐ more than 20 years

**2 YOUR COMPANY**

2.1 What is the annual turnover (latest year) of your company £\_\_\_\_\_ million

2.2 Please indicate the number of employees in your company

- ☐ 1-7                      ☐ 8 - 24  
☐ 25 - 114              ☐ 115 - 1199  
☐ 1200 and over

2.3 Please tick all the geographical areas in which your company operates.

- |   |   |
|---|---|
| <input type="checkbox"/> North            | <input type="checkbox"/> Yorkshire & Humberside |
| <input type="checkbox"/> East Midlands    | <input type="checkbox"/> East Anglia            |
| <input type="checkbox"/> South East       | <input type="checkbox"/> South West             |
| <input type="checkbox"/> West Midlands    | <input type="checkbox"/> North West             |
| <input type="checkbox"/> Wales            | <input type="checkbox"/> Scotland               |
| <input type="checkbox"/> Northern Ireland | <input type="checkbox"/> Overseas               |

2.4 Please tick all the following types of work carried out by your company

- |                   | <u>Public</u>            | <u>Private</u>           |
|-------------------|--------------------------|--------------------------|
| <u>New Work</u>   |                          |                          |
| Building          | <input type="checkbox"/> | <input type="checkbox"/> |
| Civil Engineering | <input type="checkbox"/> | <input type="checkbox"/> |

Refurbishment

- |         |                          |                          |
|---------|--------------------------|--------------------------|
| Housing | <input type="checkbox"/> | <input type="checkbox"/> |
| Other   | <input type="checkbox"/> | <input type="checkbox"/> |

2.5 Does your company have a specialised refurbishment division/ department

- ☐ Yes                      ☐ No

2.6 Does your company have a planning and/or control department ☐ Yes ☐ No

2.7 Does your company employ a construction planning specialist(s) ☐ Yes ☐ No

## Appendix C

2.8 What is the percentage turnover of refurbishment work carried out by your company over the last five years

☐ Less than 50%      ☐ 50% or more

2.9 For questions 2.5 a) to 2.5 c), tick all a) the types of building b) sizes of project and c) procurement systems of refurbishment works carried out by your company

### a) Types of Building

- ☐ Residential  
☐ School, college  
☐ Office  
☐ Industrial  
☐ Shop  
☐ Hospital  
☐ Other, please specify

### b) Sizes of project

- ☐ Less than £20 000  
☐ £20 000 to £100 000  
☐ £100 000 to £1 000 000  
☐ More than £1 000 000

### c) Procurement systems

- ☐ Traditional  
☐ Design and Build  
☐ Construction Management  
☐ Management Contracting  
☐ other, please specify

## 3.0 TYPES OF PLANNING TECHNIQUES

3.1 Please indicate the types of planning techniques produced during preconstruction planning stage (PC) and construction planning stage (C) of refurbishment projects you are involved in.

	PC	C
a. Gantt or Bar Charts	<input type="checkbox"/>	<input type="checkbox"/>
b. Line of balance charts	<input type="checkbox"/>	<input type="checkbox"/>
c. Critical path techniques or network analysis	<input type="checkbox"/>	<input type="checkbox"/>
d. Precedence diagrams	<input type="checkbox"/>	<input type="checkbox"/>

3.2 How would you describe the level of detail of the planning techniques used during the construction planning stage of the refurbishment projects

Mostly not very detailed      0000000      Mostly very detailed

## 4.0 INTEGRATIVE VARIABLES OF PLANNING AND CONTROL OF REFURBISHMENT PROJECTS

4.1 How formal were the interactions between planning participants during the construction planning stage

Mostly Very informal      0000000      Mostly Very formal

4.2 Please indicate the degree of centralisation of authority during the construction planning stage

Mostly highly decentralised      0000000      Mostly highly centralised

4.3 How clearly defined was the scope of your participation in the refurbishment projects you were involved in.

Mostly very clear      0000000      Mostly very unclear

4.4 Which of the following answers below would best describe the frequency of formal meetings that you have to attend during the construction planning stage of the refurbishment projects you are involved in.

- ☐ Never      ☐ Daily  
☐ Weekly      ☐ Every 2-3 weeks  
☐ Monthly      ☐ Every 2 months or more

4.5 Which of the following answers below would best describe the frequency of monitoring of the projects' progress during construction planning stage

- ☐ Never      ☐ Daily  
☐ Weekly      ☐ Every 2-3 weeks  
☐ Monthly      ☐ Every 2 months or more

4.6 Which of the following answers below would best describe the frequency of formal report that you have to produce during the construction planning stage

- ☐ Never      ☐ Daily  
☐ Weekly      ☐ Every 2-3 weeks  
☐ Monthly      ☐ Every 2 months or more

4.7 Please indicate to what extent the procurement systems used in refurbishment projects influence the degree of accuracy of your time estimates

To a small      To a large



extent                      OOOOOOO                      extent  
 4.8 How would you describe the degree of  
 centralisation of information at each stage of  
 planning and control of refurbishment projects you  
 are involved in

Prebid stage

The information is mostly decentralised	OOOOOOO	The information is mostly centralised
---	---------	---

Preconstruct stage

The information is mostly decentralised	OOOOOOO	The information is mostly centralised
---	---------	---

Construction stage

The information is mostly decentralised	OOOOOOO	The information is mostly centralised
---	---------	---

If you have any comments concerning the questionnaire or the research topic, please write in the space below.

.

Thank you very much for taking part in this survey. If you would like a summary of the final research results, free of charge, please enter your name and address below:

Name:

Address:

## Appendix D

### List of present job titles of the respondents to the preliminary postal questionnaire survey

Managing Director  
General Manager  
Contract director  
Contract manager  
Regional manager  
Operation Manager  
Construction director  
Regional Planner  
Area Manager  
Project Manager  
Chief planner  
Planner  
Technical director

## **Appendix E**

The Bartlett, Philips House  
University College London  
Gower Street  
London WC1E 6BT  
United Kingdom

0171 387 7050 ext 5963

January 1995

Dear Sir

### **Survey on Planning and Control Process of Refurbishment Projects**

I would like to thank you for completing and returning the preliminary postal questionnaire survey I sent to you in December. Without your support, it would have been extremely difficult to undertake this venture.

I will send to you the results of my research to you once it is completed. I hope that your company will be able to benefit directly from this research.

With much appreciation.

Yours sincerely,

Ismail Rahmat  
Researcher  
The Bartlett  
University College London.

RESULTS OF PRELIMINARY POSTAL  
QUESTIONNAIRE SURVEY

## 1 RESPONDENT'S PARTICULARS

1.2 How long have you worked in the construction industry ( % out of 103 cases)

[ 0% ] Less than a year	[ 0% ] 1- 5 years
[ 3% ] 6-10 years	[ 12% ] 11-15 years
[ 17% ] 16- 20 years	[ 67% ] more than 20 years

1.3 How long have you been involved in planning and/or controlling refurbishment projects

[ 1% ] Less than a year	[ 6% ] 1- 5 years
[ 18% ] 6-10 years	[ 25% ] 11-15 years
[ 12% ] 16-20 years	[ 38% ] more than 20 years

## 2 YOUR COMPANY

2.1 What is the annual turnover (latest year) of your company? mean £62.7 million

2.2 Please indicate the number of employees in your company

[ 3% ] 1-7	[ 12% ] 8 - 24
[ 47% ] 25 - 114	[ 33% ] 115 - 1199
[ 9% ] 1200 and over	

2.3 Please tick all the geographical areas in which your company operates (% operating in the following geographical area)

[21%] North	[17%] Yorkshire & Humberside
[26%] East Midlands	[37%] East Anglia
[87%] South East	[31%] South West
[24%] West Midlands	[15%] North West
[17%] Wales	[14%] Scotland
[8% ] N. Ireland	[12%] Overseas

2.4 Please tick all the following types of work carried out by your company (% saying yes)

	Public	Private
<u>New Work</u>		
Building	[ 93% ]	[ 94% ]
Civil Engineering	[ 20% ]	[ 21% ]
<u>Refurbishment</u>		
Housing	[ 71% ]	[ 68% ]
Other	[ 81% ]	[ 86% ]

2.5 Does your company have a specialised refurbishment division/ department  
[25%]Yes [75%] No2.6 Does your company have a planning and/or control department  
[ 53%]Yes [47%] No2.7 Does your company employ a construction planning specialist(s)  
[51%] Yes [49%] No2.8 What is the percentage turnover of refurbishment work carried out by your company over the last five years  
[60%] Less than 50% [39%] 50% or more  
1% missing value

2.9 For questions 2.5 a to 2.5c, tick all a) the types of building b) sizes of project and c) procurement systems of refurbishment works carried out by your company (% saying yes)

a) Types of Buildingb) Sizes of project

[81%] Residential	[52%] Less than £20 000
[80%] School,college	[67%] £20 000 to £100 000
[85%] Office	[86%] £100 000 to £1 000 000
[75%] Industrial	[70%] More than £1 mill
[64%] Shop	
[65%] Hospital	
[ 6% ] Other, please specify	

c) Procurement systems

[95%] Traditional
[ 77%] Design and Build
[ 19%] Construction Management
[22%] Management Contracting
[ 0% ] other, please specify

## 3.0 TYPES OF PLANNING TECHNIQUES

3.1 Please indicate the types of planning techniques produced during preconstruction planning stage (PC) and construction planning stage (C) of refurbishment projects you are involved in

	PC	C
a. Gantt or Bar Charts	[ 81% ]	[ 81% ]
b. Line of balance charts	[ 10% ]	[ 12% ]
c. Critical path techniques or network analysis	[ 43% ]	[ 46% ]
d. Precedence diagrams	[15%]	[ 13% ]

3.2 How would you describe the level of detail of the planning techniques used during the construction planning stage of the refurbishment projects (frequency)  
Mostly not detailed (4)(5)(12)(24)(26)(22)(7) Mostly very detailed

scale 1 to 7 mean 4.570

#### 4.0 INTEGRATIVE VARIABLES OF PLANNING AND CONTROL OF REFURBISHMENT PROJECTS

4.1 How formal were the interactions between planning participants during the construction planning stage (frequency)

Mostly Very informal (9)(17)(23)(25)(17)(5)(4) Mostly Very formal

Scale 1 to 7 mean 3.550  
missing cases 3

4.2 Please indicate the degree of centralisation of authority during the construction planning stage (frequency)

Mostly highly decentralised (4)(8)(9)(17)(23)(27)(10) Mostly highly centralised

Scale 1 to 7 mean 4.714  
missing cases 5

4.3 How clearly defined was the scope of your participation in the refurbishment projects you were involved in. (frequency)

Mostly very clear (16)(35)(15)(14)(8)(7)(3) Mostly very unclear

Scale 1 to 7 mean 2.959  
missing cases 5

4.4 Which of the following answers below would best describe the frequency of formal meetings that you have to attend during the construction planning stage of the refurbishment projects you are involved in

[2%] Never [34%] Daily  
[28%] Weekly [24%] Every 2- 3 weeks  
[ 4% ] Monthly [ 6%] Every 2 months or more

2% missing value

4.5 Which of the following answers below would best describe the frequency of monitoring of the projects' progress during construction planning stage.

[ 7% ] Never [51%] Daily  
[ 15%] Weekly [23%] Every 2- 3 weeks  
[ 1% ] Monthly [ 3%] Every 2 months or more  
1% missing value

4.6 Which of the following answers below would best describe the frequency of formal report that you have to produce during the construction planning stage

[ 4% ] Never [18%] Daily  
[10%] Weekly [56%] Every 2- 3 weeks  
[ 2% ] Monthly [10%] Every 2 months or more  
2% missing value

4.7 Please indicate to what extent the procurement systems used in refurbishment projects influence the degree of accuracy of your time estimates

To a small extent (7)(15)(10)(18)(15)(21)(14) To a large extent

Scale 1- 7 mean 4.38  
3% missing cases

4.8 How would you describe the degree of centralisation of information at each stage of planning and control of refurbishment projects you are involved in (frequency)

##### Prebid stage

The information is mostly (3)(6)(5)(15)(17)(27)(20) decentralised The information is mostly centralised

Scale 1 to 7 mean 5.129  
missing cases 10

##### Preconstruct stage

The information is mostly (3)(6)(7)(15)(22)(28)(13) decentralised The information is mostly centralised

Scale 1 to 7 mean 4.947  
missing cases 9

##### Construction stage

The information is mostly (8)(5)(12)(25)(18)(16)(9) decentralised The information is mostly centralised

Scale 1 to 7 mean 4.33  
missing cases 10

## Appendix G

### The number and size of construction firms visited

#### Annual turnover (1993)

£1- £10 million	3
£10 - £100	9
£101 and over	3
Total	<u>15</u>

## Appendix H

### The list of planning and control managers interviewed

Contract Manager	5
Planner	7
Production Manager	2
Resource and Planning Manager	1
Total	<u>15</u>

Letter requesting an interview

The Bartlett  
Philips House  
University College London  
Gower street  
London WC1E 6BT

Tel: 0171 387 7050 ext 5963

May 1995

**Research into Planning and Control Process of Refurbishment Projects**

I am writing to ask if you would be kind enough to let me interview you for about one-and-half an hours. I am looking into the problems of the planning and control process of refurbishment projects especially on the methods of integrating the key participants in the process.

I am a member of staff of the MARA Institute of Technology in Malaysia working for PhD, supervised by Professor Barbara Young and Professor Victor Torrance. My research started in February last year and is now entering the data collection stage. The research is linked to the research in planning and control techniques across two industrial sectors (shipping and construction) being carried out by the Department of Construction Management, University College London. My preliminary questionnaire survey was conducted last year. A manager from your company was very kind to complete and return the questionnaire to me. To complete my research I need more information on the planning and control at operational level and I believe you are the best person to approach.

I will telephone you in a few days' time to arrange the time and date for the interview. I am aware of the considerable pressure on your time, but I shall be most grateful if you agree to help me.

With much appreciation.

Yours sincerely

Ismail Rahmat

Interview sheet

Mr X  
Planning Manager

Company address:

Tel :

Date :

Time :  

---

Verify:

Company's annual turnover

Number of employees:

1.0 The characteristics of refurbishment projects

1.1 What are major problems in planning and control of refurbishment projects?

1.2 How are the problems normally handled?

1.3. What are the problems associated with the tender documents of refurbishment projects?



- 1.4. Which type of refurbishment projects (building) is more difficult to plan and control?

**Section 2: The involvement of the key participants**

Could you please tell me who are strongly involved in decision-making at the following stages of refurbishment projects;

- 2.1. pre-bid stage

- 2.2 pre-construction stage

- 2.3 during construction stage?

- 2.4 What is your view on the client's involvement in decision-making in the planning and control process?

- 2.5 Are the site managers involved during the pre-bid stage?
- 2.6 What is your view on the involvement of site manager involvement during the pre-bid stage?
- 2.3 How is the continuity of information flow from the pre-bid to the construction stage is achieved?
- 3.0 Involvement in the preparation of plans
- 3.1 Could you please tell me the types of plans which are most widely used in the planning and control process?
- 3.2 Who is involved in their preparation?
- 3.3 What is/are planning techniques used in refurbishment projects?

**3.4 Which planning techniques are the most popular and why?**

**3.5 How would you rate the level of detail of the planning techniques used in refurbishment projects:**

pre-bid	Low	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	High
Pre-construction	Low	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	High
during construction	Low	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	High

**3.6 How would you rate the skills and knowledge of the site manager and contracts manager in the preparation of planning techniques: Low ☐ ☐ ☐ ☐ ☐ High?**

**4.0 Procurement systems**

**4.1 Are refurbishment project using design and build more difficult to plan and control than those using traditional procurement system?**

**4.2 Is the degree of involvement of the participants different between these two procurement system?**

**5.0 Planning effectiveness**

**5.1 What criteria does your company use to judge the effectiveness of the planning and control process?**

## **Appendix J**

5.2 What percentage of refurbishment projects undertaken by your company exceeds the target cost?

- and target time?

5.3 What are the reasons for the time and cost over-runs?

5.4 How would you rate the quality of workmanship of the refurbishment projects you were involved in?

5.5 How is the quality of workmanship is controlled?

6.0 Co-ordination devices

6.1 How is the information for planning and control normally obtained, formally/informally?

6.2 What are the most important skills and knowledge requirements for refurbishment projects?

## **Appendix J**

- 6.3 How would you rate the level of skills and knowledge of the participants involved in refurbishment projects; Low O O O O O High?
- 6.4 To what extent are planning and control procedures used in the process ( ask for examples)?
- 6.5 Is the planning and control procedure flexible?
- 6.6 Does your company use computer software to plan and control refurbishment projects?
- 6.7 Could you name the computer software?
- 6.8 In what areas of planning and control are the computer software mostly used?

## 7.0 An example of specific projects: ask for archive documents:

**7.1 Contract Value (contract)** \_\_\_\_\_

## 7.2 Location

### 7.3 Client

**7.4 Type of building**                      **Housing/office/school/industrial/others?**

7.3 Occupied/non-occupied not occupied/partially occupied/fully occupied?

**7.5 Type of procurement system** Traditional/design and build?

## 7.6 problems encountered?

## 8.0 Request for help

**8.1 Could you suggest the best approach to ensure high rate of response for my questionnaire?**

## 8.2 What is the typical size of refurbishment project undertaken by your company?

The Bartlett  
University College London  
22 Gordon Street  
London WC1H 0QB  
tel 0171 387 7050 ext 4883  
fax 0171 380 7517

## Appendix K

Barbara Young BA(Hons) PhD MCIOB  
Professor of Construction Management

### TO WHOM IT MAY CONCERN

14 October 1995

#### *Research into Refurbishment Contract Management by Mr Ismail Rahmat*

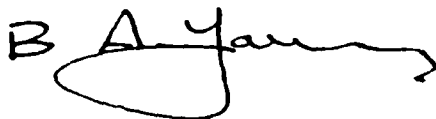
This is simply a brief introductory letter to inform you that Mr Ismail Rahmat is conducting research into the Planning and Control Processes of Construction Refurbishment Contracts. He is working under the supervision of Professor Victor Torrance and myself at the Bartlett School.

Mr Rahmat is a staff member of the Mara Institute of Technology in Malaysia, who is on secondment to UCL in order to carry out the research work leading to a Ph.D degree.

My colleagues and I are aware of the considerable pressure on your time, but we shall be most grateful if you will complete the questionnaire attached to Mr Rahmat's letter enclosed and return it to him at your earliest possible convenient opportunity.

With much appreciation

Yours faithfully,



Professor Barbara Young

Encs.



The Bartlett School of Architecture, Building,  
Environmental Design and Planning  
Faculty of the Built Environment

## SURVEY ON PLANNING AND CONTROL PROCESS OF REFURBISHMENT PROJECT

Return Address

Ismail Rahmat  
The Bartlett, Philips House  
University College London  
Gower Street  
London WC1E 6BT

Reference /

Telephone 0171 387 7050 ext 5963

**Note about the questionnaire:**

Please answer every question. If you are unable to answer some questions because you consider them irrelevant or unclear, please put a question mark next to them. However, we hope you will answer the remainder of the questionnaire.

Your identity and that of your firm will remain strictly **confidential** to us.

**Refurbishment** refers to all works carried out on existing building. This includes modernisation, conversion, renovation, rehabilitation, retrofit and repair. It excludes regular maintenance works such as painting, cleaning and decoration.

Most questions can be answered by marking one of the circles or spaces provided.

e.g. How much emphasis does your company place on formal procedures for planning and control of the refurbishment project

very  
low emphasis    OOOOO    high emphasis

### 1. YOUR PARTICULARS

1.1 Job title: \_\_\_\_\_

1.2 How long have you worked in the construction industry

☐ Less 5 years      ☐ 5 - 10 years      ☐ 10 - 15 years      ☐ 15 years or more

1.3 How long have you been involved in planning and/or controlling refurbishment projects

☐ Less 5 years      ☐ 5 - 10 years      ☐ 10 - 15 years      ☐ 15 years or more

1.4 How long have you been working in your present company

☐ Less 5 years      ☐ 5 - 10 years      ☐ 10 - 15 years      ☐ 15 years or more

Before you answer the rest of the questionnaire, please **select** a completed refurbishment project carried out by your present company in which you were actively involved. The project must satisfy the following criteria: -

- a. The site work started after **31 December 1991**
- b. Contract value more than **£500 000** (half a million pounds)
- c. The procurement system was either **traditional** or **design and build**.

**PLEASE ANSWER THE REMAINDER OF THE QUESTIONNAIRE  
BASED ON THE PROJECT YOU HAVE SELECTED.**



## 2.0 PROJECT CHARACTERISTICS

For questions 2.1 to 2.6, please indicate the refurbishment project characteristics in the spaces provided.

2.1 Type of building ☐ Residential ☐ Office ☐ Shop ☐ School/college  
☐ Industrial ☐ Hospital ☐ Others, please specify \_\_\_\_\_

2.2 Procurement system ☐ Traditional ☐ Design and Build

2.3 The contract value ( in million pounds) of the refurbishment project

☐ £0.5 - £1.0 ☐ £1.1 - £1.5 ☐ £1.6- £2.0 ☐ £2.1 - £2.5 ☐ £2.6- £3.0 ☐ £3.1 -3.5  
☐ £3.6 -£4.0 ☐ £4.1- £4.5 ☐ £4.6 -£5.0 ☐ £5.1 - £5.5 ☐ £5.6 -£6.0 ☐ more than £6.0

2.4 The date of commencement of site work Month \_\_\_\_\_ Year \_\_\_\_\_

2.5 Project duration (excluding extension of time) \_\_\_\_\_ weeks

2.6 Project duration (including extension of time, if any) \_\_\_\_\_ weeks

## 3.0 PROJECT COMPLEXITY AND UNCERTAINTY

For questions 3.1 to 3.7, please tick the appropriate spaces provided

3.1 Number of subcontractors employed in the refurbishment project

☐ 10 or less ☐ 11 -15 ☐ 16 -20 ☐ 21 -25 ☐ 26 to 30 ☐ More than 30

3.2 Value of services work ( as percentage of contract value) of the refurbishment project

☐ 20% or less ☐ 21%- 25% ☐ 26% - 30% ☐ 31%-35% ☐ 36% to 40% ☐ More than 40%

3.3 Value of structural work (as percentage of contract value ) of the refurbishment project

☐ 10% or less ☐ 11%- 15% ☐ 16% - 20% ☐ 21%-30% ☐ 31% to 35% ☐ More than 35%

3.4 Value of provisional sum work as percentage of contract value of the refurbishment project

☐ 5% or less ☐ 6%- 10% ☐ 11% - 15% ☐ 16% -20% ☐ 21% to 25% ☐ More than 25%

3.5 How complete was the design of the refurbishment project when work commenced on site

☐ less than 20% ☐ 20% - 40% ☐ 41% -60% ☐ 61% -80% ☐ more than 80%

3.6 Was the building(s) occupied when the refurbishment work was carried out during construction period?

☐ not occupied ☐ partly occupied ☐ fully occupied

3.7 Was the refurbishment project a joint-venture project or partnership ☐ Yes ☐ No

For questions 3.8 to 3.13, please indicate the characteristics of the refurbishment project on the circles provided

3.8 Ease of access to the site very easy OOOOO very difficult

3.9 Amount of space available for storage of material on site very small OOOOO very big

3.10 Impact of weather on the refurbishment project very low OOOOO very high

3.11 Availability of labour scarcity of labour OOOOO high labour surplus

3.12 Availability of material scarcity of material OOOOO high material surplus

3.13 Changes in design made by client during construction very small extent OOOOO very large extent

#### 4.0 PLANNING AND CONTROL TOOLS

4.1 Please indicate, the planning technique(s) that was most widely used in the refurbishment project  
☐ Bar/Gantt Chart ☐ Critical Path Method or ☐ Precedence Diagram ☐ Others, please specify  
 Network Analysis \_\_\_\_\_

4.2 Please indicate the short term plans produced during construction stage of the refurbishment project  
☐ Daily ☐ Weekly ☐ Fortnightly ☐ Monthly ☐ Others, please specify  
 \_\_\_\_\_

4.3 Did your company use project management computer programmes or software for planning and controlling the refurbishment project  
☐ Yes ☐ No

4.4 Please rate the degree of detail of the planning techniques(i.e, bar Chart/Gantt Chart, Critical Path Method and Precedence Diagram) at the following planning and controlling stages of the refurbishment project

a. Prebid stage	very brief	OOOOO	very detail
b. Post-bid/Preconstruct stage	very brief	OOOOO	very detail
c. During construction	very brief	OOOOO	very detail

4.5 To what extent the planning technique(s) prepared during prebid stage was used at post-bid/preconstruction stage	very small extent	OOOOO	very large extent
--	-------------------	-------	-------------------

4.6 To what extent the planning techniques(s) was used for monitoring the refurbishment project during construction	very small extent	OOOOO	very large extent
---	-------------------	-------	-------------------

#### 5.0 DEGREE OF INVOLVEMENT

Question 5.1 to 5.2, are relating to the degree of involvement of the key participants including yourself in planning and controlling of the refurbishment project. For example, if you are a contract manager, please rate your degree of involvement by marking the appropriate circles below contract management. Please rate the degree involvement of other participants as well.

**NOTE:**  
 Degree of involvement means the degree of participation and/or contribution of the participant in the process.  
 The key participants are the estimator, planner, contract management, site management and subcontractors.  
 Contract management (Contract Mgt) covers contract director and contract manager  
 Site management (Site Mgt) covers project manager, site manager and site agent

5.1 Please rate the degree of involvement in decision making process of the key participants and client in the planning and controlling stages listed below of the refurbishment project. (decision making process includes information gathering, development of alternatives and choice making)

**KEY**      1 = not involved or not available    2 = low involvement    3 = medium involvement    4 = high involvement

	Estimator				Planner				Contract Mgt				Site Mgt				Sub-contractors				Client			
Stages	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Prebid	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Post-bid/Preconstruction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
During construction	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

5.2 Please rate the degree of involvement of the key participants and client in the preparations of the functional plans listed below in the refurbishment project.

Note:

Planning techniques are the Bar/Gantt Chart, Critical Path Method and Precedence Diagram

Short term plans are the daily, weekly, fortnightly and monthly plans.

KEY 1 = not involved or not available 2 = low involvement 3 = medium involvement 4 = high involvement

	Estimator	Planner	Contract Mgt	Site Mgt	Sub contractors	Client
	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4	1 2 3 4
<b>Functional plans</b>						
a. Planning techniques	OOOO	OOOO	OOOO	OOOO	OOOO	OOOO
b. Short term plans	OOOO	OOOO	OOOO	OOOO	OOOO	OOOO
c. Method Statement	OOOO	OOOO	OOOO	OOOO	OOOO	OOOO
d. Site layout	OOOO	OOOO	OOOO	OOOO	OOOO	OOOO

## 6. COORDINATION MECHANISMS

Note:

The key participants are the estimator, planner, contract management, site management and subcontractors .

6.1 To what extent planning and control procedures, if any, were used in the planning and control process of the refurbishment project

very small extent OOOOO very large extent

6.2 How would you rate the degree of communication skill and knowledge of the key participants in planning and control of the refurbishment project?

very low OOOOO very high

6.3 Were the key participants in the refurbishment project given performance targets so that they could use the targets to assess their performance?

none of them were given OOOOO all of them were given

6.4 Was the information on planning and controlling for the refurbishment project mostly located centrally at the head office or mostly dispersed among the key participants in the planning and controlling stages listed below

a. At prebid centrally located OOOOO dispersed

b. At post-bid/preconstruction centrally located OOOOO dispersed

c. During construction centrally located OOOOO dispersed

6.5 Please indicate the frequency the site management (site manager and/or project manager) had to produce a formal report on the progress of the refurbishment project during construction stage

[ ] Every day [ ] 1 to 2 weeks [ ] 3- 4 weeks [ ] Every month or more [ ] Never

6.6 Please indicate the frequency the site management had to monitor the planning technique (i.e Bar Chart/Gantt Chart and/or Critical Path Method and/or Precedence Diagram) of the refurbishment project during construction stage

[ ] Every day [ ] 1 to 2 weeks [ ] 3- 4 weeks [ ] Every month or more [ ] Never

6.7 Listed below are four methods the key participants (i.e., estimator, planner, contract management, site management and subcontractors) could obtain information on planning and controlling. Please rate the degree of importance of the methods of obtaining information in the refurbishment project. (1 for least important and 5 for very important)

	1	2	3	4	5
a. Regular schedule meeting attended by majority of the key participants					
b. Special /unscheduled meetings: attended by majority of the key participants to discuss a concern of one of the key participants					
c. Direct Informal contact among the key participants					
d. Direct formal contact among the key participants					

6.8 Please rate the level of disagreement in planning and controlling between the key participants below in the refurbishment project

a. Between planner and contract management	very low	OOOOO	very high
b. Between planner and site management	very low	OOOOO	very high
c. Between contract management and subcontractors	very low	OOOOO	very high
d. Between contract management and site management	very low	OOOOO	very high
e. Between site management and subcontractor	very low	OOOOO	very high

## 7. THE PROJECT PLANNING OUTCOMES

7.1 Please indicate the ratio of actual construction cost to target construction cost of the refurbishment project ( e.g. if the actual cost was £1 500000 and the target cost was £1 400 000, divide £1500000 by £1400000, so the ratio is 1.07)

[ ] Less than 0.90 [ ] 0.91 to 0.95 [ ] 0.96 to 1.00 [ ] 1.01 to 1.05 [ ] 1.05 to 1.10 [ ] More than 1.10

7.2 please indicate the ratio of actual construction time to target construction time of the refurbishment project (e.g. if the actual time was 24 weeks and the target time was 20 weeks, divide 24 by 20, so the ratio is 1.2)

[ ] Less than 0.80 [ ] 0.81 to 0.9 [ ] 0.91 to 1.00 [ ] 1.01 to 1.1 [ ] 1.11 to 1.2 [ ] More than 1.2

7.3 Please indicate how often the planning technique had to be revised during construction stage in the refurbishment project

[ ] None [ ] 1 -5 times [ ] 6- 10 times [ ] More than 10 times

7.4 How would you rate the clients' satisfaction when the building in the refurbishment project was handed over to them

very unsatisfied OOOOO very satisfied

7.5 Please rate the quality of workmanship of the refurbishment project

very low OOOOO very high

## 8. YOUR COMPANY

8.1 Average company turnover over the last 3 years. (to the nearest million pounds)

[ ] Less than £1 m [ ] £1 m to £10 m [ ] £11 m to £100 m [ ] More than £100 m

8.2 Please indicate whether your company had any of the following departments/divisions when the refurbishment project was carried out

[ ] Surveying [ ] Planning [ ] Contract [ ] Estimating [ ] Accounting/Finance  
 [ ] Personnel [ ] Legal [ ] Insurance [ ] Maintenance [ ] Administration or Office services  
 [ ] Refurbishment [ ] Safety [ ] Quality control and/or assurance [ ] Training & Development  
 [ ] Plant and/or equipment [ ] Purchasing/Buying [ ] Mechanical & Electrical services  
 [ ] Others, please specify \_\_\_\_\_

8.3 Was the scope of work of the employees in your company clearly described when the refurbishment was carried out      not clearly described      OOOOO      very clearly described

8.4 Did your company have written rules that the employees must obey in carrying their day-to-day works when the refurbishment project was carried out?      no written Rules      OOOOO      extensive written rules

8.5 Please indicate the management level in your company whose approval must be obtained before the following actions could be taken when the refurbishment project was carried out.

**Junior managers (JM)** covered the site personnel from an ordinary worker to the site manager  
**Middle managers(MM)** covered the Managers whose positions are between site manager and General managers  
**Senior managers(SM)** covered General Manager and Board of Directors.

	<u>JM</u>	<u>MM</u>	<u>SM</u>
8.5.1 Labour force requirements on site	[ ]	[ ]	[ ]
8.5.2 Appointment of subcontractors on the site	[ ]	[ ]	[ ]
8.5.3 Number of foremen/supervisors required on the site	[ ]	[ ]	[ ]
8.5.4 Number of technical personnel on the site	[ ]	[ ]	[ ]
8.5.5 Negotiation with client and/or client's representative on site	[ ]	[ ]	[ ]
8.5.7 Selection of plant and equipment for the project	[ ]	[ ]	[ ]
8.5.8 Choices of construction methods for the project	[ ]	[ ]	[ ]

If you have any comments concerning the questionnaire or the research topic, please write on the space below

Thank you very much for taking part in this survey. If you would like the summary of the final research results, free of charge, please enter your name and address

Name      Address

The Bartlett, Philips House  
University College London  
Gower Street  
London WC1E 6BT

Tel- 0171 387 7050 ext 5963

13 November 1995

Dear Sir,

**Survey on Planning and Controlling Process of Refurbishment Projects**

Three weeks ago I sent to you a questionnaire on planning and controlling process of refurbishment project. I am still anxious to get a reply from you and hoping that you are still willing to help me

It is generally agreed that planning and controlling are among the most difficult tasks facing managers in refurbishment projects. I anticipate that with your help the results will contribute to improving this situation. I hope that you and your company could benefit directly from this research as I will send to you the result of the research free of charge if you write your name and address at the end of the questionnaire

I would like to assure you that both your identity and that of your company will remain strictly confidential

For your convenience, I enclose another copy of the questionnaire. I would be very grateful if you could return it to me as soon as possible.

With much appreciation.

Yours faithfully

Ismail Rahmat

## Appendix N

Characteristics of the construction projects	Singular		Complex		Normal	
	10	9	8	7	6	5
Owner or investor						
Intergovernmental						
Multinational consortia						
Governmental bodies						
Enterprises or private groups						
Not usually private						
Combination of the above						
Cost and financing						
Very large budgets						
Budgets over several years						
Not financed by regular budgets of organizations and enterprises						
Many finance sources						
Large investment at relatively short term						
Long recovery length of investment						
Terms of study and execution						
Long period of gestation of the project (many years)						
Long duration of studies (> 5 years)						
Long duration of execution (> 3 years)						
Work staged according to needs						
Partial start up of part of project						
Stages of the project						
Requires viability studies						
Requires feasibility studies						
Execution of conceptual engineering						
Execution of detailed engineering						
Requires stage of procurement						
Construction						
Start up						
Closing and shut down						
Administrative and legal framework						
International, national or local regulations						
Special laws and regulations						
Authorizations and licences of different government offices						
Internal operating system (procedure handbooks)						
Audit and control by various organizations						
Impact on natural and social environment						
Great impact on environment (flora and fauna)						
Modification of landscape						
Modification of basins, levels, large cut and fill						
Alteration of local and regional economies						
Creation of large temporary work-force						
Important concentration of people and resources						
Impact on customs and social behaviour at the site						
Physical localization						
Strategic siting						
Dissimilar geographical areas						
Distance from urban areas						
Relatively distant from supply centres						
Difficulty of access						
Important expropriations						
Cost of rights of way						
Technology						
Need for specific research for the project						
Use of technology specially developed						
Need of important technology						
New equipment, machinery and materials						
Normal complementary techniques used						
Resources						
Large number of specialized workers						
Large number of engineering specialists						
Concentration of equipment and machinery of different size capacity and origin						
Many contractors and subcontractors						
Great variety of suppliers of equipment and machinery, national and imported						
Services: safety camps, maintenance, support, control, commuting, etc.						
Logistics of the construction						
New access to work site (harbour, roads, railways)						
Power supply - electric lines, fuel, water, etc.						
Important temporary buildings (camps, offices, warehouses, workshops, etc)						
Varied systems of communication, local and external						
Important installations for urgent medical attention, amusement, leisure						

Source: Gerardo Santana Classification of construction projects by scales of complexity. The Journal of International Project management, Vol. 8 No 2 May 1990, Butterworth & Company (Publishers) Ltd

## Appendix O

Associations between the situational variables and the involvement of key participants in decision making of refurbishment project during pre-bid stage

Refurbishment project situational variables	estimators	planning specialists	contract mgt	site mgt	sub-contractor	clients
project contract value	0.15	0.12	0.05	0.17	0.19	0.05
% of services work to project contract value	-.02	.17	.16	.03	.29*	.23
% structural work to project contract value	-.23	-.04	-.18	.20	.16	.02
% of provisional sum to project contract value	-.19	.08	.15	.08	.07	-.12
number of subcontractor	.08	.22	.05	.21	.05	.16
Degree of completeness of design before work start on site	-.02	.15	.17	.25*	.15	.04
degree of access on project site	-.10	-.05	-.04	-.13	.04	-.07
amount of space available on site	-.19	-.14	-.07	.14	.11	-.02
Availability of labour	-.12	-.24	.15	.16	.13	.31*
Availability of material	-.04	-.15	.03	.22	.13	.21
procurement system	-.07	-.18	.09	.04	.13	.02

\* at 0.05 significant level    \*\* at 0.01 significant level



## Appendix P

Associations between degree of complexity and uncertainty of situational variables and degree Involvement of key participants in decision making pre-construction stage

Refurbishment project situational variables.	estimators	planning specialists	contract mgt	site mgt	subcontractors-	clients
project contract value	0.14	0.01	0.03	0.10	0.18	0.05
% of services work to project contract value	-.02	.14	-.01	.04	.19	.00
% structural work to project contract value	-.06	-.04	-.19	-.06	-.10	.06
% of provisional sum to project contract value	-.33*	-.16	.10	.34**	.06	-.11
number of subcontractor	.12	.12	.13	.08	.09	-.09
Degree of completeness of design before work start on site	.05	.13	.00	.06	.15	.03
changes made by the clients during construction	-.01	.21	-.08	.07	.02	.07
degree of access on project site	-.21	-.24	-.09	.04	.20	.03
amount of space available on site	-.04	-.17	.05	.10	.01	.09
Availability of labour	.15	-.15	-.13	.09	.12	.26*
Availability of material	-.02	-.20	.04	.24	.19	.26*
Impact of weather	.02	-.05	.10	.21	.16	.16
procurement system	.11	-.16	-.07	-.20	.09	.05

\*  $p \leq 0.05$

\*\*  $p \leq 0.01$

## Appendix Q

Associations between degree of complexity and uncertainty of situational variables and degree of involvement of key participants during construction stage.

project situational variables .	estimators	planning specialists	contract mgt	site mgt	sub contractor	clients
project contract value	0.08	0.26	-.37**	-.01	-.06	-.11
% of services work to project contract value	-.07	.12	-.04	.25*	.09	.03
% structural work to project contract value	.02	-.03	.02	.03	-.04	-.02
% of provisional sum to project contract value	-.30*	.01	-.01	.19	-.11	-.10
number of subcontractor	.21	.29*	-.26*	-.07	-.07	-.11
Degree of completeness of design before work start on site	.02	.35**	-.09	-.11	-.13	-.08
changes made by the clients during construction	-.02	.14	.00	.00	-.12	-.03
degree of access on project site	-.06	-.13	-.15	.14	-.14	-.21
amount of space available on site	-.02	-.04	.10	.16	-.04	.02
Availability of labour	.03	.09	-.12	.21	.31*	.07
Availability of material	.17	.06	-.14	.13	.14	.08
Impact of weather	.05	-.03	.18	.22	.23	.22
procurement system	.06	-.03	-.11	-.04	-.04	.08

\* at 0.05 significant level    \*\* at 0.01 significant level

## Appendix R

Associations between situational variables and the lateral relations

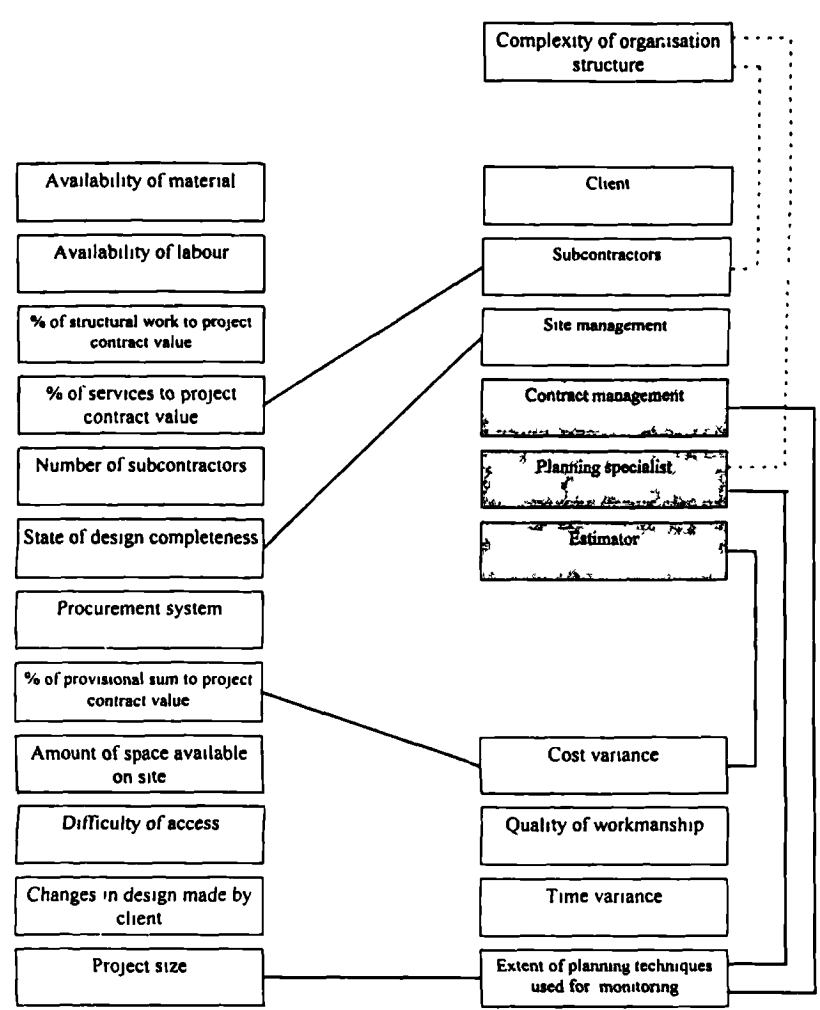
Situational variables	scheduled meeting	special meeting	formal contact	informal contact
Project contract value	-.01	.05	-.02	-.01
% of services work to project contract value	-.03	.06	-.02	.09
% structural work to project contract value	-.10	.00	-.04	.06
% of provisional sum to project contract value	-.20.	-.15	.01	.01
number of subcontractors	-.08	-.02	-.25	-.02
Percentage of design completed before work started on site	.05	-.12	-.13	.06
changes made by the client during construction	.00	-.11	-.07	.11
degree difficulty of access to project site	-.03	-.28*	-.03	.08
amount of space on project site for storage of material	-.04	.03	.00	.00
Procurement system	.00	.08	-.11	-.01

## Appendix S

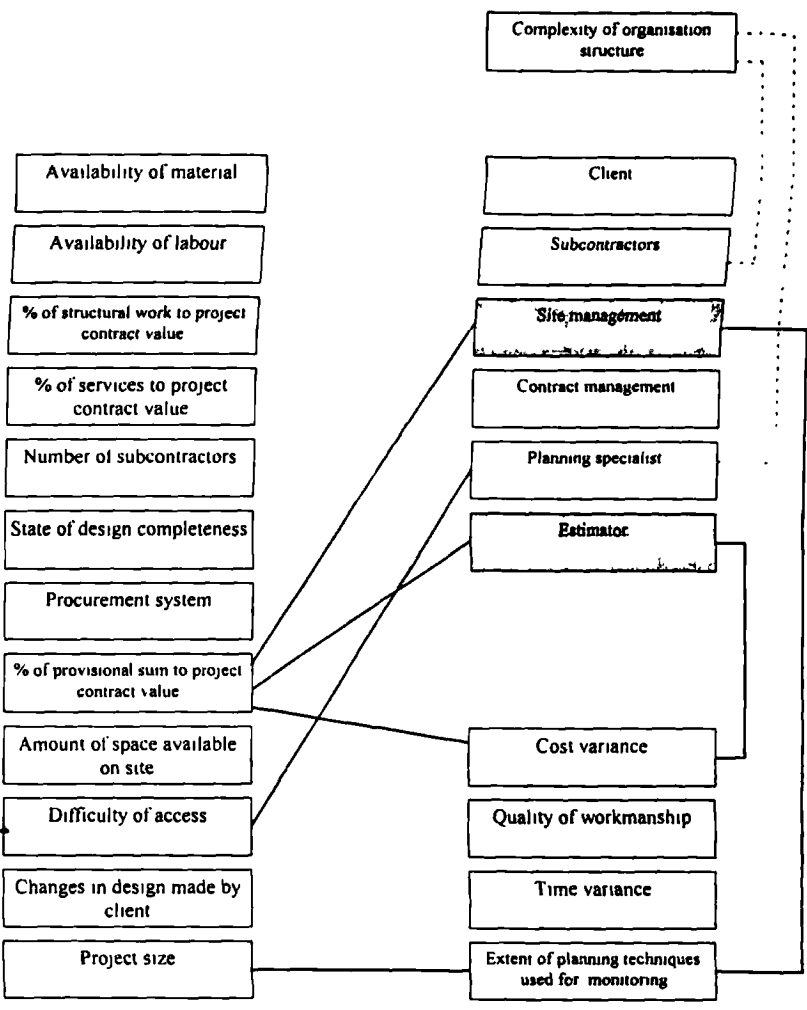
### The Associations between situational variables and co-ordination devices

situational variables	Procedures	communication skills and knowledge	Project management computer software
Project contract value	.29*	.33**	0.45**
% of services work to project contract value	.19	-.04	.09
% structural work to project contract value	.20	.00	-.09
% of provisional sum to project contract value	.05	.05	-.13
Number of subcontractors employed in the refurbishment project	.18	.17	.26
Percentage of design completed before work started on site	.06	-.09	.23*
changes made by the client during construction	-.02	.06	-.04
degree difficulty of access to project site	.07	.05	-.06
Amount of space on project site for storage of material	-.01	-.23	.01
Procurement system	.24*	.11	-.03

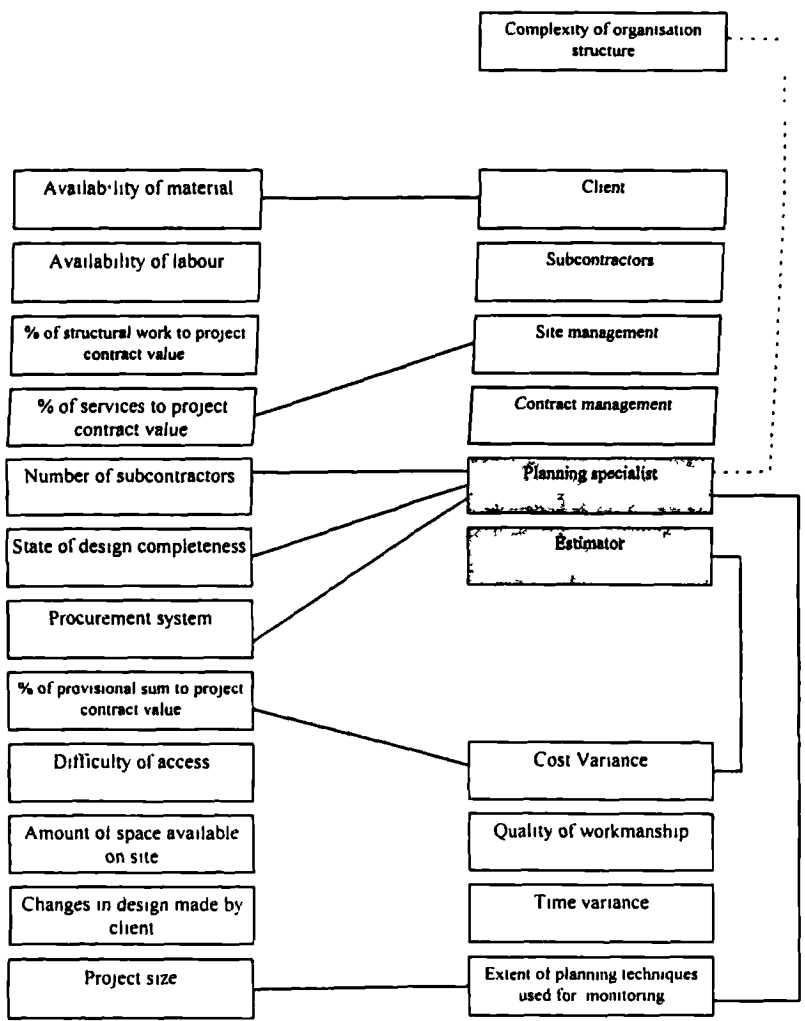
A model of the involvement of the key participants in decision-making during pre-bid.



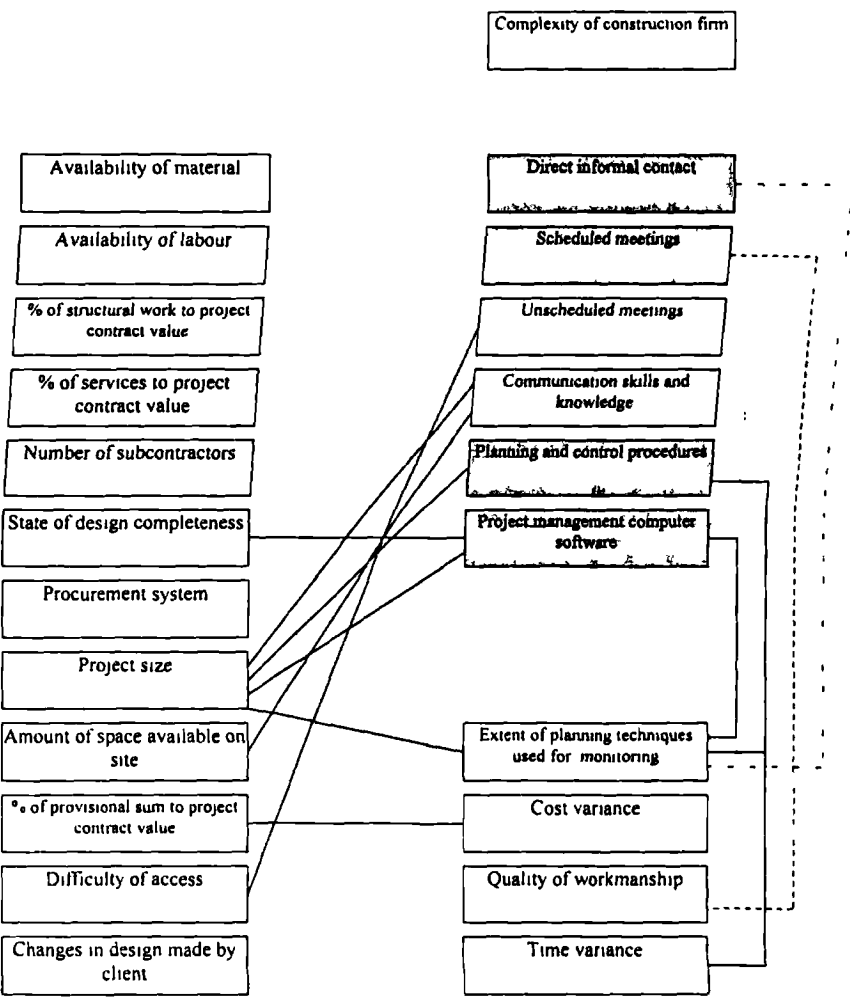
A model of the involvement of the key participants in decision-making during pre-construction



A model of the involvement of the key participants in decision-making during construction stage.



The co-ordination devices model



## References

- Ackoff, R.L. (1970) A concept of Corporate Planning, Wiley, New York
- Adams, J. S. (1956) An experiment on question and response bias, *Public Opinion Quarterly*, 36, Summer, pp 254-257
- Adams, J. and Martin, M.D. (1982) A practical approach to the assessment of project uncertainty, in proceedings of the PMI Symposium, Toronto.
- Ahmad, I.U. (1990) Decision support system for modelling bid/no bid decision problem, *Journal of Construction Engineering and Management*, ASCE, 116(4), 595-608.
- Ahuja, H.N. and Nandakumar, V. (1984) Enhancing reliability of project duration forecasts, and transactions, the American Association of Cost Engineering, Montreal, E.6.1-E.6.12
- Aikivuori, A. (1996) Periods and demand for private sector refurbishment, *Construction Management and Economics*, 14, UK. pp. 3-12.
- Altry, J.L. (1993) IT in the construction industry - another tower of babel, The impact of information technology on built asset management, CIB 1990; Proceedings of the Building Economic and Construction Management, 14-21 March, Sydney, Australia, pp. 195-203.
- Anisi, A.M.; Salinas, E.C. and Agudo, A.R. (1990) Cost Model for Economic pre-evaluation in rehabilitation construction, CIB' 90; Building Economics and Management, 14-21 March, Sydney, Australia, pp. 172-181.
- Ansoff, H. I. (1994) comment to Henry Mintzberg's rethinking strategic planning , *Journal of Range Planning*, vol 27.
- Aouad, G. And Price, A.D.F. (1994) Construction planning and information technology in the UK and US construction industries: a comparative study, *Construction Management and Economics* 12, 97-106.
- Arditi, D. (1981) A comparison of attitudes to planning in industrialized and developing countries. Proc. PMI INTERNET Joint Symp. Boston, Mass. pp 641-649.
- Arditi, D. And Koseoglu, H. (1983) Factors affecting success in network applications in a developing country, *Construction Management and Economics*, 1, pp. 3-16.
- Argyris, C. (1972) The applicability of organizational theory, Cambridge University press, Cambridge.
- Ashworth, A. and Skitmore, R.M. (1983) Accuracy in estimating, Occasional paper 27, CIOB

- Babbie, E.R. (1973) Survey Methods, Wadsworth publishers.
- Badawy, M.K. (1982) Developing managerial skills in engineers and scientists, Van Nostrand Reinhold, New York.
- Bale, J. (1985) Training for a new age, Building, 24 May, p. 38-39.
- Ball, M. (1980) The contracting system in the construction industry, IMEO, Birkbeck College, UK.
- Banwell, Sir Harold (1964) The placing and management of building contracts, Ministry of Public Building and Works, HMSO, UK.
- Bass, B.M. and Leavitt, H.J. (1963) Some experiments in planning and operating. Management Science, 9, 574-85
- Bennett, J. (1985) Construction project management, Butterworths, London. pp.214
- Bennett, J. (1991) International construction project management general theory and practice, Butterworth-Heinemann Ltd, Oxford, pp 102-106
- Bennett, J. and Fine, B. (1980) measurement of complexity in construction projects, report, Department of Construction Management, University of Reading, UK.
- Bennett, J. and Flanagan, R. (1983) Management options: new directions, Building, April pp. 32 -33.
- Bennett, J. and Ormerod, R.N. (1984) Simulation applied to construction projects, Construction Management and Economics, Vol 2. pp 225-263
- Birch, N. and Williams, J. (1968) Organisation structure Building 23, 6 September, 138-40.
- Birrell, G.S. and Jouini, K. (1984) The construction contractor's managerial 'hiccup' as he evolves from a one man operation to an organised company. In proceedings of the 4th International Symposium on organisation and management of construction . University of Waterloo, Canada, pp. 125-33.
- Blau, P. M. and Schoenherr, R.A. (1971) The structure of organisations, Basic Books, New York.
- Boisot, M. (1986) Markets and hierarchy in a cultural perspective, Organisational studies, 7(2), 135-58.

Bouchard, T.J. Jr. (1976) Field research methods, interviewing, questionnaires, participant observation, systematic observation, unobtrusive measures, in Handbook of Industrial and Organisational Psychology, Marvin D. Dunnette (Ed.) Rand McNally College Publishing Co., Chicago, USA. pp 363-413

Boyd, D. and Jankovich, L. (1993) The limits of intelligent building refurbishment, Journal of Property Management, Vol 11, no. 2, pp. 102-113

Boyd, D. and Weaver, P. (1994) Improving the management and operations of refurbishment projects, Proceedings of the 10th.ARCOM Annual Conference, 14-16 September, 1994, Loughbrough University of Technology, UK.

Brandon, P.S. and Powell, J.A. Quality and profit building design E & F N Spon, London. pp 339-349

Brandon, P.S.; Basden, A.; Hamilton, I. And Stockley, J. (1988) The Strategic Planning of Construction Projects, RICS Publications, London.

Bresnen, M. (1990) Organising construction: Project organisation and matrix management, Routledge, London. pp 2-10.

Briscoe, G., Dutton, P.A. and Lindley, R.M. (1980) Skilled labour in engineering and construction , economic change and employment policy, R.M. Lindley, Ed., Macmillan Press.

British Research Establishment (1990) Assessing traditional housing for rehabilitation. HMSO, London, UK.

British Research Establishment (1990b) Outline guide to assessment of traditional housing for rehabilitation, Building Research Establishment, UK.

British Telecom and the Department of Environment (1995) Construct it- bridging the gap: an information technology strategy for the UK construction industry, March,1995, Construction Sponsorship Directorate.

Brochner (1993) Bridging Gap in IT: Construction process improvement in market network, proceedings of the 1st International Conference.

Bromilow, F.J. (1971) Building contract performance, the Building Economist, 9, 126-138

Buckley, J.W.; Buckley, M.H. and Chiang, H. (1976) Research methodology and business Decisions, National Association of Accounts and Society of Industrial Accounts of Canada.

Buffa, E.S. (1976) Operations management: The Management of Productive Systems, Wiley, Santa Barbara, CA

Building Employers Confederation (BEC) (1987) Simple guide and flow chart for selection the appropriate JCT form of contract, BEC, London, UK.



Burns and Stalker (1961) The management of innovation, Tavistock, London.

Bus, F.B.M., and Kruyswijk, A.J. (1977) Participative decision making under conditions of uncertainty, Second International Conference on Participation, Workers' Control and Self-management, Paris, September, Paris.

Cassimatis, P.J. (1969) Economics of Construction Industry, the National Conference Board, Inc New York, N.Y

Catt, R. (1992) Taking action to stop Britain's heritage going to rack and ruin, Chartered Surveyor Weekly, 1 October, pp. 26-27.

Centre for Construction Market Information (1988) Market Appraisal for research on maintenance, repair and refurbishment operations in construction, Ed. P A Denison, Vol. 1, CCMI, London. pp 4.

Centre for Strategic Studies of Construction (CSSC) (1989) Investing in building 2001, CSSC, University of Reading, UK.

Chapman, C.B., Phillips, E.D., Cooper, D.R. and Lightfoot, L. (1985) Selecting an approach to project time and cost planning, Project Management, 3, 1, 19-26.

Charmer, K.G. (1987) Project management of refurbishment and refurbishment work, Maintenance, 2 March, p. 12-14.

Chartered Institute of Building (CIOB)(1988), Project management in Building, 2nd Edition, Ascot, UK.

Cheetham, D.W. and Jaggar, D.(1990) Procurement systems: which way forward, Proceedings of the CIB W92: Procurement Systems, 10th -13th September, Yugoslavia.

Child, J. (1984) Organisation. A guide to problems and practice, Harper Row, London

CIRIA (1994)A guide to the management of building refurbishment, London.

Clark, P. (1989) Social technology and structure, chapter 6 in Hillebrandt and Cannon (eds). The management of construction firms: aspects of theory and practice, Macmillan, London, UK.

Clausen, J.A and Ford, R.N. (1947) Controlling bias in mail questionnaire, Journal of American Statistical Association, Vol. 42, September, pp. 497 -511.

Clegg, S. (1992) Contracts cause conflict, in Fenn, P.and Gameson, R..(Eds.) Construction conflict: management and resolution, Spon, London, UK.

Cleland, D.I. and King, W.R. (1975) Systems analysis and project management, 2nd edn. McGraw-Hill, New York .

Cohenca, D.; Laufer, A. and Ledbetter, W.B. (1987) Factors affecting construction planning efforts, *Journal of Construction Engineering and Management*, vol 115, No. 1, ASCE. pp 70-89

Cohenca- Zall, D.; Laufer, A.; Shapira, A. and Howell, A.G. (1994) Process of planning during construction, *Journal of Construction Engineering and management*, vol 120, No. 3, ASCE. pp 561-579.

Connors, M.M, Harrison, A.A. and Summit, J. (1994) Crew systems: Integrating human and technical subsystems for the exploration of space, *Behavioural science*, Vol. 39. Pp. 183-212.

Construction industry Training Board (CITB,1988) Survey of supervisory and management training needs in the UK construction industry, vol. 1 and 2.

Contract Survey (1989) Contracts in use, *Chartered Quantity Surveyor*, January, pp. 24-26.

Cooke, B.(1993) Contract planning and contractual procedures, Third Edn, MacMillan Hampshire.

Cormican, D. (1985) Construction management : planning and finance, Construction Press, London, England.

Crozier, M. (1964) *The Bureaucratic phenomenon*, Tavistock, London

Crozier, M. and Thoenig, J-C. (1976) 'The regulation of complex organizational systems', *Administrative Science Quarterly* 21: 547-70.

Cyert, R. And March, J.G. (1963) *A behavioural theory of the firm*, Englewood, Cliffs, N.J. Prentice-Hall.

Daft, R. L. and Lengel, R. H. (1986) Organisational information requirements, media richness and structural design, *Management Design*, 32(5), 554-71.

Dawood, N.N. (1995) an integrated bidding management expert system for the make order precast industry, *Construction Management and economics* 13, 115-25.

Department of Environment (DoE) (1993) Housing and construction statistics, H.M.S.O., London, UK.

Department of Environment (DoE) (1994) Housing and construction statistics, H.M.S.O., London, UK.

Department of Environment (DoE)(1988) English house condition survey: 1986, H.M.S.O., London, UK.

- Dermer, J. (1977) Management planning and control systems. Irwin-Dorsey, Georgetown, Ontario.
- Dewar, R. and Hage, J. (1978) Size, technology, complexity and structural differentiation: toward a theoretical synthesis. *Administrative science Quarterly*, 26, pp. 449-69
- Dickson, J. (1981) The relation of direct and indirect participation, *Industrial Relations Journal*, July/August:27-35
- Dillman, D.A. (1972) Increasing mail questionnaire response in large sample of general public, *Public Opinion Quarterly*, 36, Summer, pp 254-257
- Douglas,, N. (1988) Refurbishment, rehabilitation and renovation, CIB W65, *Managing Construction World-wide*, 7-10 September, London, Vol.3, pp. 67-81
- Duncan, R.B. (1972) Characteristics of organizational environments and perceived environmental uncertainty, *Administrative Science Quarterly*, Vol 17. pp 313-327
- Eccles, R.G. (1981) The quasi-firm in construction, *Journal of Economic Behaviour and Organisation*, 2.
- Egbu, C.O. (1994) Management education and training for construction work within the construction industry, Ph.D thesis, vols 1 and 11, Department of Civil Engineering and Construction , University of Salford, England.
- Emerson, R. (1962) ' Power dependence relations', *Administrative Science Review*, 27: 31-40
- Emery, J.C. (1969) Organizational planning and control systems, theory and technology, Macmillan, London
- Emmerson, Sir, H.(1974) Survey of problems before the construction industries, HMSO, UK.
- Evamy, M. (1988) A weighty matter of substance, *Contract Journal*, 29 September, pp. 24-5.
- Ewing, D.W. (1969) The human side of planning: tool or tyrant. Macmillan, London.
- Faniran, O.O., Oluwoye, J.O. and Lenard, D. (1994) Effective construction planning, *Journal of Construction Management and Economics*, 12, E & F.N. Spon. pp 485-499
- Fellows, R.F.; Newcombe, R. and Langford, D.A.(1985) Client control of commercial refurbishment projects, Final Report of a pilot study sponsored by the science Engineering Research Council (SERC), Grant no. GR/D/10923, December.

Fenn , P. (1991) Managing corporate conflict and settling disputes on construction projects, proceedings of the 7th Annual conference, ARCOM, University of Bath, UK..

Fenn, P.(1992) Managing the contractual relationship: privatisation and project management, proceedings of the 8th Annual conference, ARCOM, 18th -20th September, Douglas, Isle of Man, UK., pp. 81-87

Ferry, D.J. and Brandon, P.S. (1991) Cost planning of refurbishment and repair work, in Cost Planning of Buildings (Eds. Ferry, D.J. and Brandon, P.S.) Chapter 19, pp. 247-250, Sixth edition, BSP Professional Books, Oxford, UK.

Fiedler., K. (1987) Special conditions for time scheduling of building modernisation process, International Journal of Project Management, 9,1, Butterworth- Heinemann, p. 53-60

Filley, A.C., House, R.J. and Kerr, S. (1976) Managerial process and organizational behaviour, Foresman, Glenview, Illinois.

Fine, B. (1975) Tendering strategy: in aspects of the economics of construction (ed. D.A. Turin), Godwin, London, UK.

Forsgren, R.A. (1986) Increasing mail survey response rate: methods for small business researchers, Journal of Small Business Management, Vol. 27, Part 4, pp. 61-66

Fowler, F.J. Jnr. (1984) Survey research methods. Sage Publications, London

Franks, J. (1990) Procurement in the 1990s, Chartered Quantity Surveyor, The Royal Institution of Chartered Surveyors, UK, February.

Franks, J. (1992) Design and build tendering: do we need a code of practice ?, Chartered Builder, The Chartered Institute of Building, UK., Vol 4. No. 5, June.

Futrell, C.M, and Hise, R.T. (1982) The effect of anonymity and same day deadline on the response rate to mail surveys, European Research, October, pp. 171-175.

Futrell, C.M. (1981) Effects of using both confidentiality and anonymity in survey research on the sales of force, American Marketing Association Educator's Conference Proceedings, pp. 391-393.

Gael, S. (1983) Job analysis, Jossey Bass, San Francisco, USA.

Galbraith, J.R. (1977) Organization design, Addison-Wesley, Reading, MA

Gilkeson, R.J. (1981) You can plan and schedule better. Newsletter, Association of Professional Planners and Schedulers 3, 1, 1-7.

Gorgone, R.G. (1992) Improving overhaul planning through risk assessment and risk management, *Journal of Ship Production*, vol. 8, No.4, November, pp. 235 - 243

Griffith, A. (1989) design and build procurement and buildability, Occasional Paper no. 112, The Chartered Institute of Building, UK.

Guevara, J.M. (1979)) Communication in construction companies, PhD thesis, University of Illinois at Urbana-Champaign, Urbana, Ill.

Gunnarson, S. And Levitt, R. (1982) Is a building construction project a hierarchy or a market ? In *Proceedings of Seventh Internet Conference*, Copenhagen, pp. 1-19.

Hage ,J. Aiken, M. And Marrett (1971) Organisation structure and communication, *American Sociological review*, (Oct.): p. 860-871

Hakman, I. (1975) More rational alteration work, report refurbishment, 14, National Swedish Building research.

Hall, R.H. (1972) Organizations: structure and process, Prentice-Hall, Inc., Englewood Cliffs, N.J. pp 146

Hamilton, I. (1987) developing expert systems for management applications, in building cost modelling components, Brandon, P.S. (ed.) Spon, London, UK.

Hamilton, I. (1990) A review of United Kingdom procurement methods, proceedings of the CIB- W92, procurement systems, 10th-13th September, Yugoslavia.

Hardcastle, C. (1990) Information transfer between design and construction, in proceedings of CIB 90- Building Economics and Construction management, 14-21 March, Sydney, Vol.2, pp. 12-21.

Hardy, B. (1979) private sector refurbishment: a survey of developers and contractors in Birmingham, University of Aston in Birmingham.

Harrison, F.L. (1981) Advanced Project Management, Wiley, New York.

Harrison, F.L. (1992) Advanced project management: a structured approach, 3rd. Ed., Gower, Aldershot, pp95-'45

Hayes-Roth, B. and Hayes-Roth, F. (1979) A cognitive model of planning. *Cognitive Science* 3, 275-310.

Heberlein, T.A. and Baumgarter, R. (1978) Factors affecting response rates to mailed questionnaires: a qualitative analysis of published literature, *American Sociological review*, Vol. 46, pp. 447-462.

Heller, F., Drenth, P., Koopman, P. and Rus, V. (1989) Decisions in organizations: a three-country study, SAGE Publications, London, 11-12

Heller, F.A and Wilpert, B. (1981) Competence and power in managerial decision making, Wiley, Chichester.

Heller, F.A. (1971) Managerial decision making: a method of field research, *Psychological Bulletin* 72,108-17

Henley, J.R. (Jr) (1976) Response rate to mail questionnaire with a return deadline, *Public Opinion Quarterly*, Vol. 40, pp. 374-375.

Herbst, P.G. (1974) *Socio-technical design*, Tavistock, London.

Hickson, D.J., Hinnings, C.R., McMillan, C.J.M. and Schwitter, J.P. (1974) The culture -free context of organization structure: a tri-national comparison, *Sociology* 8: pp 59-80.

Higgin, G. and Jessop, N. (1965) *Communications in building industry*, Tavistock, London, UK.

Highfield, D. (1987) *Rehabilitation and re-use of old buildings*, E & F. N. Spon, London, UK.

Hillebrandt, P.M. (1974) *Economics theory and the construction industry*, Macmillan, London, UK.

Hollins, R.J. (1971) *Production and planning applied to building*, Rev. ed., George Godwin, London.

Horvat, B. (1982) *The political economy of socialism*, M.E Sharpe, Armont, New York.

Horvat, B. (1986) *Industrial partnership: utopia or necessity?* The 1986 Scott Bader Commonwealth Lecture, monograph 13, Wollaston, Wellingborough.

Howell, G.A. (1990) *How owners and contractors organize project teams*, Source Document 50, Construction Industry Institute, University of Texas, Austin, TX

Howell, G.A., Laufer, A. and Ballard, G. (1993) Uncertainty and project objectives, *Project Appraisal Journal*, 8,37-43

Hughes, W. (1992) *Developing construction procurement law*, proceedings of the 8th Annual Conference, ARCOM, 18th-20th September, Isle of Man, UK, pp. 97-110.

Hughes, W. and Murdoch, J.(1992) *Construction contracts law and management*, E & F.N Spons.

Imbert, I.D.C. (1987) *International construction in developing countries*, Proceedings of the CIB W65, International Symposium, Vol.3, p. 82-95.

Industrial Market Research (IMR) Ltd (1987) Private office refurbishment : the current market and future prospects, research work commissioned by Touche Ross, UK.

Institute of Building Code of Estimating Practice (1979), Fourth Edn., Chartered Institute of Building.

Ireland, V. (1985) The role of managerial actions in the cost, time and quality performance of high rise commercial building projects, *Construction Management and Economics*, 3, 59-87.

Jackson, M.J. (1986) Computers in construction planning and control< Allen & Unwin, London, UK. P. 1-11.

Jenkins, G.D. Jr and Lawler, E.E. (1981) Impact of employee participation in pay plan development. *Organizational Behaviour and Human Performance* 28, 111-28

Jobber, D. (1991) Choosing a survey method in management research, in the *Management Research Handbook*, Smith, N.C. and Dainty, P. (Eds.), Routledge, pp. 174-180

Jobber, D.(1986) Improving response rates in industrial mail surveys, *Industrial Marketing Management*, Vol. 15, pp. 183 -185.

Jothiraj, T. and Fellows, R. (1986) Client control of commercial refurbishment projects, CIB, 10th Triennial Congress, Washington, U.S.A, 22-26 September, Vol. 7, p. 2837 -2845.

Kabaskal, H.E.; Sozen, Z. and Usdiken, B. (1989) Organisational context, structural attributes and management systems in construction firms, *Construction management and economics*, 7, pp 347-351

Kanuk, L. and Berenson, C. (1975) Mail Surveys and response rates: a literature review, *Journal of Marketing research*, Vol. X11, November, pp. 440-453.

Kavic, B., Rus, V. and Tannebaum, A.S. (1971) Control, participation and effectiveness, *Administrative Science Quarterly* 16: 74-86.

Keidal, R. (1984) Baseball, football and basketball: models for business, *Organisational Dynamics* 12 Winter, 5-18.

Kerin, R.A. and Harvey, M.G. (1976) Methodological considerations in corporate mail surveys: a research note, *Journal of Business research*, 4(3) , pp. 277-281.

Kerlinger, F.N.(1976) Foundations of behaviour research, Holt Rhienhart and Winston.

Kerzner, H. (1984) Project management: a system approach to planning, sheduling and controlling, Van Nostrand Reinhold, Ne York

Kimberly, J.R. (1976) Organisation size and the structuralist perspective: a review, critique and proposal. *Administrative Science Quarterly*, **21**, pp. 571-97

Kingdon, D.R. (1973) *Matrix organisation*, Tavistock, London.

Koehn, E. and Towers, S.E.(1982) Current aspects of construction rehabilitation, *Journal of Construction Division, Proceedings of the American Society of Engineers*, ASCE, Vol. 108, CO2, June, p. 330-340.

Koontz, H. and O'Donnel, C. (1972) *Principles of management: an analysis of managerial functions*, 5th edition, McGraw-Hill, Tokyo . pp 199-227

Koontz, H., O'Donnell, C. and Weinrich, (1986) *Essentials of management*, 4th Edn. MacGraw-Hill, N.Y.

Landsberger, H. (1961) The Horizontal dimension in bureaucracy, *Administrative Science Quarterly*, December, 1961 pp 300

Lange, J.E. (1979) *Pricing private construction in the construction industry* (edited by J.E.

Lansley, P. (1994) Analysing construction organizations, *Construction Management and Economics*, **12**, 337-348.

Latham, Sir M (1994) *Constructing the team, a joint review of procurement and contractual arrangements in the UK , construction industry* , London, HMSO, July.

Laufer A., Denker, G. And Shenhar, A (1996) Simultaneous management: the key to excellence in capital projects, *International Journal of Project Management*, Vol. 14, Elsevier Science Ltd and IPMA, UK.

Laufer, A. (1989) *Owner's project planning: the process approach*, Source Document 45, Construction Industry Institute, University of Texas, Austin, TX.

Laufer, A. (1990) Factors affecting construction-planning outcomes, *journal of Construction Engineering and Management*, vol. 116, **1**, March 1990. pp 136

Laufer, A. (1991) Construction planning in uncertain environments, *International Project Management*, **9** (1), pp 53-60

Laufer, A. (1991)Project planning: timing issues and path of progress. *Project Management Journal*, **22** (2), 39-45

Laufer, A. (1992) A micro view of the project planning process, *Construction Management and Economics*, 1992, **10** ,E & F.N. Spon . 31-43



Laufer, A. and Cohenca, D. (1987) Factors affecting planning efforts and outcomes, technical report, Building Research Station, Technion, IIT, Haifa, Israel.

Laufer, A. and Tucker, R.L (1988) competence and timing dilemma in construction planning, *Construction Management and Economics*, 6, F & N Spon pp 339-55.

Laufer, A., Shapira, A., and Cohenca-Zall, D. (1992a) The process of construction planning and its product: practice in mature companies, Research Report, National Building Research Institute, Technion-IIT, Haifa, Israel.

Laufer, A., Tucker, R.L., Shapira, A., and Shenhar, A.J. (1994) The multiplicity concept in construction project planning, *Construction Management and Economics*, 11, 53-65.

Laufer, A.; Shapira, A. and Cohenca-Zall, D. (1993) Prebid and preconstruction planning process, *Journal of Construction Engineering and Management*, vol 119, No. 3, ASCE..pp 426-443

Lawrence, P. R. and Lorsch, J.W. (1967) *Organization and environment*, Harvard Business School, Boston, MA

Lawrence, P.R. (1981) *Organization and environment perspective*, in Van de Ven, A H and Joyce, W F *Perspectives on organizational design and behaviour*, John Wiley and Sons, New York

Lawrence, R.L. and Lorsch, J.W. (1967) *Organization and Environment: Managing Differentiation and Integration*, Harvard University, Mass.

Le Breton, P.P. and Henning, D.A. (1961) *Planning theory*, Prentice- Hall, Englewood Cliffs, NJ

Leavitt, H.J. and Klahr, D. (1967) *Tasks, organisation structures and computer programs, the impact of computers on management*, (Ed. C.Myers), Technical Press, Mass.

Levine, S. And Gordon, G. (1958), *Maximising returns on mail questionnaires*, *Public Opinion Quarterly*, 22, Winter, pp. 568-575.

Lewis, T.W. and Fox, R.A. (1969) *managing with statistics*, Oliver and Boyd, Edinburgh.

Lewis, W.A. (1969) *The principles of economic planning*, Unwin, London. P. 17

Lichtenberg, S. (1981) *Real world uncertainties in project budgets and schedules*, *Proceedings of INTERNET Joint Symposium Boston MA*. pp 179-193

Lichtenberg, S. (1986) *Medieval remains in modern project management and successor principles for the nineties*. In *Project Management in Progress* (edited by M.C. Grool et al.), Elsevier Science Publishers B.V., Amsterdam, Holland.

Likert, R. (1967) *The human organization: Its management and value*, McGraw-Hill, London.

Linsky, A.S (1965) A factorial experiment in inducing responses to a mail questionnaire, *Sociology and Social Research*, Vol. 49, pp. 183-189.

Locke, E.A. and Schweiger, D.M. (1979) Participation in decision-making: one more look, in

Lorsch, U.W. and Morse, J.J. (1974) *Organizations and their members*, Harper and Row, new York

Luthens, F. (1992) *Organisational behaviour*, 6th Edn. McGraw- Hill International, Singapore pp 31

MacCrimmon, K.R. and Taylor, R.N. (1976) Decision making and problem solving. In *Handbook of International and Organizational Psychology* (edited by M.D. Dunnette), Rand McNally, Chicago.

Male, S. and Stock, R (1989) Managers and the organisation, in Hillebrandt, P.M. and Cannon, J. (Eds.) *The management of construction firms : Aspects of theory*, Macmillan, London. Chapter 7.

March and Simon (1958) *Organisations*, Wiley, New York.

Marsh, P. (1983) *The refurbishment of commercial and industrial buildings*, construction press, London. pp3

Mason, D. (1984) The CPM technique in construction: a critique. *Transactions of the American Association of Cost Engineers*, Chicago, pp. B.3.9.

Masterman, J.W.E (1988) *An introduction to building procurement systems*, E & F.N Spon, London.

Matteson, M.T. (1974) Type of transmittal letter and questionnaire color as two variables influencing response rate in mail survey, *Journal of Applied Psychology*, 59, August, pp. 532-536.

McGartland, M.R. and Hendericken, C.T. (1995) Expert systems for construction project monitoring, *Journal of Construction Engineering and Management ASCE*, 121(3),293-307.

McGowan, P.H.; Randall, C.W. and Horner, R.M.W. (1993) Resource significant models for estimating, planning and control in construction

McKenney, J.L. and Keen, P.G.W. (1974) How managers' mind work. *Harvard Business Review*, 79-90.

Meggison, L.C., Mosley, D.C. and Pietri, Jr. P.H. (1992) management concepts and applications, 4th Edn., Harper-Collins, New York.

Michael, D. (1973) Learning to plan and planning to learn, J.Bass, San Francisco, Calif.

Miles, R.E. (1965) Human relations or human resources, Harvard Business Review 43: 148-63

Mintzberg (1979) the structuring of organisations, Prentice Hall, New Jersey. P. 252

Mintzberg , (1980) The manager's job: folklore and facts, Harvard Business review (HBR), 53, pp. 49-61.

Mintzberg, H. (1973) The nature of managerial work. Harper & Row, New York.

Mintzberg, H. (1981) Research notes and communications, what is planning anyway ? Strategic Management Journal, 2, 319-24

Mintzberg, H. (1994) Rethinking strategic planning , vol 27, no 3, Elsevier Science Ltd, England. Pp. 12-21.

Moavenzadeh and Rossow, J.K., (1974) The construction industry: A review of the major issues facing the industry in the US., Research report 74-44, Department of Civil Engineering, Massachusetts Institute of Technology, Cambridge, Mass.

Mohan, S.M. (1990) Expert system s applications in construction management and engineering, Journal of Construction Engineering and Management, ASCE, 116(1),87-89.

Mohsini, R.A. and Davidson, C.H. (1992)Determinants of performance in the traditional building process, Journal of Construction Management and Economics, 10. pp343-359

Morad, A.A. and Belivean, Y.L. (1991) Knowledge-based planning system, Journal of Construction Engineering and Management, ASCE, 117(1),1-12.

Morton, G.H.A. (1983) Human dynamics in project planning. In Project Management Handbook (edited by D.I Cleland and W.R King). Van Nostrand Reihold, New York, pp 265-82.

Moselhi, O. and Nicholas, M.J. (1990) Hybrid expert system for construction planning and scheduling, Journal of Construction Engineering and Management, ASCE, 116(2), 221-38.

Moser, C.A. and Kalton, G. (1979) Survey methods in social investigation. Gower Press, Aldershot, Hant.

Nahapiet, H. And Nahapiet, J. (1985) A comparison of contractual arrangements for building projects. Construction Management and Economics, Vol. 3 (No.3)

Nahapiet, J. and Nahapiet, H. (1985) The management of design and construction: the management of construction projects, case studies from the USA and U.K, the Chartered Institute of Building, Ascot p 18.

Nam, C.H. and Tatum, C.B. (1992) Non-contractual methods of integration on construction projects, Journal of Construction Engineering and management , vol. 118, no 2, June 1992, ASCE, Stanford, USA. P. 385

Naoum, S. (1994)Critical analysis of time and cost of mgt and traditional contracts, Journal of Construction Engineering and mgt, Vol. 120, No.4, December, 1994, USA, pp. 689-706

Naoum, S.G. (1994) Critical analysis of time and cost of management and traditional contracts, Journal of Construction Engineering and Management, vol 120, No. 4. pp696-697.

Naoum, S.G. and Coles, D. (1990) Procurement methods and project performance, proceedings of CIB w-92 (procurement systems), Spain, December, Publication 14.5, pp. 1-22.

Naoum, S.G. and Langford, D.(1990) An investigation into the performance of management contracts and the traditional methods of building procurement, proceedings of the CIB'90, Building economics and Construction management , Sydney, 14th -21short term plans March, Vol. 4, pp. 351-360

Naoum, S.G.and Langford, D.(1987) Management contracting, Journal of Construction Engineering and Management, ASCE, Vol. 113, no. 3, September.  
National Economic Development Office (NEDO) (1991) Partnering, contracting without conflict, London UK.

National Economic Development Office (NEDO)(1991) Partnering: Contracting without Conflict, London, UK.

Neale , R.H. and Neale, D.E. (1989) Construction planning, Thomas Telford, London

Nutt, P. (1976) Models for decision-making in organisations and some contractual variables which stipulates optimal use, Academy of Management Review, 84-98.

O'Brien, J.J. (1984) CPM in Construction Management, 3rd edition, McGraw-Hill, New York

Okoroh, M.C. (1992) knowledge-based decision support system for the selection and appointment of subcontractors for building refurbishment contracts, Ph.D thesis, Loughbourough University.

Ouchi, W. (1980) Markets, bureaucracies and clans, *Administrative Science Quarterly*, 14, 129-41.

Payne, C. (1977) The preparation and processing of survey data. exploring data structures, vol. 1, C.A. O' Muirchearaigh and C. Payne Ed., J. Wiley, Chichester.

Pennings, J.M. (1976) Dimensions of organisational influence and their effectiveness correlates, *Administrative Science Quarterly*, 21, pp. 688-99.

Perrow, C. (1972) *Complex Organizations: A Critical Essay*. Glenview, Illinois, USA.

Phatak, A.V.(1983) *International dimensions of management*, Kent Publishing Company, USA.

Pickford, D. (1983) How Haslemere does it, special report: refurbishment and conservation, *Chartered Surveyor Weekly*, 13 October, pp. 94-96.

Pietroforte, R (1997) Communication and governance in the building process, *Construction Management and Economics*, 15, 71-82, FN Spon, UK.

Pin, T.H. (1991) Risk perception of contractors in competitive bidding for refurbishment, RICS, London, UK.

Pugh, D.S. (1969) The context of organisation structures, *Administrative Science Quarterly*, 14, 91-114.

Pugh, D.S. and D.J., Hinnings, C.R. (1969) An empirical taxonomy of work organisations, *Administrative Science Quarterly*, vol.13, no 1, pp. 65-105.

Pugh, D.S., Hickson, D.J., Hinnings, C.R. and Turner, C. (1969) The context of organisation structures, *Administrative Science Quarterly*, 14, 91-114.

Quah, L.K. (1986) Contract documentation for reducing variability in refurbishment work, 10th Triennial Congress, Washington, USA, 22nd- 26th September, Vol. 9 pp. 3916-3923.

Quah, L.K. (1991) Perceptions and management of the risks in tendering for refurbishment work, *Building research Information*, vol 19 no 6.

Quah, L.K. (1992) Comparative variability in tender bids for refurbishment and new build work, *Construction Management and Economic Journal*, 10, 263-269  
*Quarterly*, 20 (Fall), pp 593-598

Ramanujam, V., Venkatraman, N. And Camillus, J.C. (1986) Multi-objective assessment of effectiveness of strategic planning : a discriminant analysis approach, *Academy of Management Journal*, 29(2), pp. 347-372.

Reuschemeyer, D. (1986) *Power and division of labour*, Polity Press, Oxford, UK.

Reve, T and Levitt, R.E. (1984) Organisation and governance in construction, Project management, 2, pp. 17-25.

Robbin, S.P. (1988) Organisational design and structure, Prentice-Hall, NJ. USA. pp 129

Robinson, N.M. (1990) Contractual Terms for property maintenance and refurbishment projects, : Their development, selection and interpretation, Proceedings of International Council for Building, CIB -W70 Building Maintenance World-wide, 7th-9th March, Singapore, vol. 2, pp. 1253-1262

Robinson, P. (1987) New-build or refurbish, Architect Journal, 19 & 26 August, pp. 64-67.

Rossow, J.K. and Moavenzadeh, (1974) The construction industry: A review of the major issues facing the industry in the US., Research report 74-44, Department of Civil Engineering, Massachusetts Institute of Technology, Cambridge, Mass.

Rowlinson, S.M. (1986) An analysis of design and build construction and traditional approach, Ph.D thesis, Brunel University, England.

Royal Institution of Chartered Surveyors (1982) Refurbishment and alteration work, Quantity surveying Documentation, R.I.C.S., October, UK.

Rus, V. (1977) The internal and external influences affecting industrial enterprises, in L.

Rus, V. (1984a) The future of industrial democracy, International social Science Journal 36: 233-54.

Rus, V., Odar, M., Heller, F., Brown, A., Drenth, P.J.D., Koopman, P.L., Wierdsma, A.F.M.,

Sadler, P. and Barry, B. (1970) Organisational development, case studies in the printing industry, London, Longmans.

Santana, G. (1990) Classification of construction projects by scales of complexity, The Journal of project Management, Vol 8, No 2, May 1990. pp 102

Sayles, L. and Strauss, G. (1966) Human behaviour in organisation, Prentice Hall, Englewood Cliffs, N.J. pp. 424.

Schein, E.H. (1978) Career dynamics, Addison Wesley, Reading, Mass, USA.

Scott, C.(1961) Research on mail surveys, Journal of Royal Statistical Society, 124, Series A, part 2, pp. 143 -191.

Shapira, A. and Laufer, A. ( 1993) Evolution of involvement and effort in construction planning throughout project life, *International project Management*, vol 11 no 3 August. pp 155-164

Shapira, A., Laufer, A. and Shenhar, A.J. (1994) Anatomy of decision making in project planning teams, *Construction Management and Economics*, **12** (3), 172-182

Shapiro, M.J.(1970) Discovering interviewer bias in open-ended survey responses, *Public Opinion Quarterly*, 34, pp. 412-415

Sidewell, A.C. (1979) A field study of organisational forms, Report, Department of Construction and Environmental Health, University of Aston, Birmingham, UK.

Simon, H.A. (1960) *The new science of management decisions*. Harper & Row, New York.

Sinclair, M.A. (1975) Questionnaire designs, *Applied Ergonomics*, Vol. 6, Part 2, pp. 73-80.

Skitmore, R.M. and Marsden, D.E. (1988) Which procurement system ?. Towards a Universal Procurement Selection technique, *Construction Management and economics*, 6, pp. 71-89.

Smith, B.D.(1989) Risk management in repair work decision making, *Naval Engineers Journal*, May, pp. 220-230.

Snyder, N.H. (1982) Research notes and communications, what is planning anyway ? A rejoinder, *Strategic Management Journal*, **3**, 265-7

Sozen, Z. (1985) Size, technology and aspects of structure in construction firms in Turkey, *Construction Management and Economics ASCE*, **115**(4), pp. 602-671.

Staw, B.(ed.) *Research in organizational behaviour*, Jai Press, Greenwich, Conn.

Steiner, G. (1979) *Strategic planning : what every manager must know*, the Free press, New York.

Stinchcombe, A.L. (1959) Bureaucratic and craft administration of production: a comparative study. *Administrative Science Quarterly*, **4**, 80-94

Stone, P.A. (1966) *Building Economy*, Pergamon press, Oxford.

Stukhart, G., Heme, W.L. and Neil, J.M. (1986) *Construction contractor planning for fixed price construction*. A report to the Construction Industry Institute, Texas A&M University, TX

Sudman, S. and Bradburn, N.M. (1982) *Asking questions : a practical guide to questionnaire design*, Jossey-Bass, San Francisco.

Summers, A.P. and Fellows. R.F. (1987) How to refurbish occupied buildings, *Building Technology and Management*, August/September, pp34-35.

Swanton, R. (1990) UK procurement procedures: contractual procedures for building, proceedings of an international workshop, University of Liverpool, UK, July, pp. 23-34.

Syal, M.G.; Grobler, F.; Willenbrock, J.H. and Parfitt, M.K. (1992) construction project process planning model for small-medium builders, *Journal of Construction Engineering and Management*, ASCE, New York. pp 653.

Tan, R.R. (1995) Information technology and perceived competitive advantage: an empirical study of engineering consulting firms in Taiwan, *Journal of Construction and Management and Economics*, 14, 227-240.

Tannebaum, A. (1968) *Control in organization*, McGraw-Hill, New York.

Tavistock Institute (1966) *Interdependence and uncertainty : a study of the building industry*, Tavistock, London UK.

Boundaries, ed. Miller, E.J. and Rice, A.K, Tavistock Publications, London.

Teo, D.H.P.; Quah, L.K.; Torrance, V.B. and Okoro, M.L. (1991) Risk evaluation and decision support system for tendering and bidding in refurbishment contracts, *Proceedings of the European Symposium on Management, Quality and Economics in Housing and other Building Sectors*, (Eds. Brandon, P.S. and Bezelga, A.), 30 September - 4 October, Lisbon, Portugal, pp. 301-319.

The Chartered Institute of Building (1987) *Refurbishment and modernisation supplement no 1 the Code of Estimating Practice*, CIOB, Englemere. pp28

Then, D.S.S. (1990) The impact of information technology on built asset management, CIB 1990; *Proceedings of the Building Economic and Construction Management*, 14-21 March, Sydney, Australia, pp. 195-203.

Thompson, J.D. (1967) *Organizations in action*, McGraw-Hill, New York

Thompson, M. (1984) *Industrial postal surveys*, Industrial Market Research Association Seminar, April.

Thompson, P. and Perry, J. (1992) *Engineering construction risks, A guide to project risk analysis and management*, Thomas Telford, London.

Torrance, V.B. (1992) The development of the construction project management processes: An Overview, proceedings of the International Conference on Tall Buildings- Reach for the Sky, 28th-30th July, Kuala Lumpur, Malaysia, pp. 247-254.



Trist, E. (1981) The evolution of sociotechnical systems as a conceptual framework and as an action perspective. In perspectives on Organisation Design and Behaviour (edited by A.H. Van de Ven and W.F. Joyce), Wiley, New York, USA.

Trull, S.G. (1966) Some factors involved in determining total decision success. Management Science, 271-9.

Turner, D. (1987) The construction industry in Britain, Midland Bank Review, Autumn, pp. 16-23.

Van de Ven. A.L., Delbecq, A.L., Koenig, R. (1976) Determinants of co-ordination modes within organisations, American Sociological review, April: p. 332-338.

Walker, A. (1989) Project management in construction, 2nd. Edition, BSP Professional books, London.

Watson, R. (1997) Partnering crisis loom, Contract Journal, 14 November, p.1.

Warner, M. (1984) The impact of new technology on participative institutions and employee involvement. The management implications of new information technology, Ed. N. Piercy, Croom Helm, Kent, U.K.

Weick, K. (1969) The social psychology of organizing. Addison-Wesley, Reading, Mass.

Westwood, P. and Morris, A. (1990) Towards an expert system for the evaluation of housing use prior to refurbishment , CIB'90, Building Economics and Management, 14-21 March, Sydney, Australia, p. 650-653; vol. 2.

Whiteman, W.E. and Irwig, H.G. (1988) A disturbance scheduling technique for managing refurbishment work, Journal of Construction Engineering Management, 114, no 2, ASCE, Mass. Pp. 191-213.

Wildavsky, A. (1973) If planning is everything, maybe it's nothing, Policy Sciences, 4, 127-53.

Williamson, O. (1975) Transaction-cost economics: the governance of contractual relations, Journal of Law and Economics, 22, 233-61

Wilson, P. (1983) The Building client, proceedings of construction industry Research Association (CIRIA), Management Contracting Conference, London, December.

Winch, G. (1989) The construction firm and construction project: a transaction cost approach, Construction Management and Economics, 7, pp 335-345

Woodward, J. (1965) Industrial Organization: Theory and Practice. Oxford University Press, London.

Young, B. (1988) Career development in construction management, a PhD thesis, University of Manchester.

Young, B., Torrance, V.B. and Egbu, C.O. (1996) Managing refurbishment works in the construction and shipping industries, Faculty of the Built Environment, University College London, UK.

Young, B. and Egbu, C.O. (1993) The characteristics and difficulties associated with refurbishment and the need for education and training for refurbishment from a management perspective, Proceedings of the 9th Annual Conference of the Associations of Researchers in Construction Management (ARCOM), 14-16, Sept, Oxford University, UK, pp. 228-350.

